Operating Instructions

Differential pressure transmitter DPT-10

GB

Metallic measurement diaphragm
Foundation Fieldbus

Differential pressure transmitter DPT-10

WIKA

Part of your business

Contents

Safety instructions for Ex areas

Please note the Ex-specific safety information for installation and operation in Ex areas. These safety instructions are part of the operating instructions manual and come with the Ex-approved instruments.

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1 About this document

1.1 Function

This operating instructions manual provides all the information you need for mounting, connection and setup as well as important instructions for maintenance and fault rectification. Please read this information before putting the instrument into operation and keep this manual accessible in the immediate vicinity of the device.

1.2 Target group

This operating instructions manual is directed to trained specialist personnel. The contents of this manual should be made available to these personnel and put into practice by them.

1.3 Symbolism used

Information, tip, note
This symbol indicates helpful additional information.

Caution: If this warning is ignored, faults or malfunctions can result.

Warning: If this warning is ignored, injury to persons and/or serious damage to the instrument can result.

Danger: If this warning is ignored, serious injury to persons and/or destruction of the instrument can result.

Ex applications
This symbol indicates special instructions for Ex applications.

- **List**
  The dot set in front indicates a list with no implied sequence.

→ **Action**
This arrow indicates a single action.

1 **Sequence of actions**
Numbers set in front indicate successive steps in a procedure.

Battery disposal
This symbol indicates special information about the disposal of batteries and accumulators.

2 For your safety

2.1 Authorised personnel

Mount and set up the pressure transmitter only if you know the applicable national regulations and have the appropriate qualification. You must be aquainted with the regulations and instructions for hazardous areas, measurement and control technology as well as electrical circuits because the pressure transmitter is "electrical equipment" according to EN 50178. Depending on the application conditions, it is necessary that you have appropriate knowledge, e.g. concerning corrosive products or high pressure.

2.2 Appropriate use

DPT10 is a differential pressure transmitter for measurement of flow, level, differential pressure, density and interface.

You can find detailed information on the application range in chapter "*Product description*".

Operational reliability is ensured only if the instrument is properly used according to the specifications in the operating instructions manual as well as possible supplementary instructions.

For safety and warranty reasons, any invasive work on the device beyond that described in the operating instructions manual may be carried out only by personnel authorised by the manufacturer. Arbitrary conversions or modifications are explicitly forbidden.

2.3 Warning about incorrect use

Inappropriate or incorrect use of the instrument can give rise to application-specific hazards, e.g. vessel overfill or damage to system components through incorrect mounting or adjustment.

2.4 General safety instructions

This is a high-tech instrument requiring the strict observance of standard regulations and guidelines. The user must take note of the safety instructions in this operating instructions manual, the country-specific installation standards as well as all prevailing safety regulations and accident prevention rules.

The instrument must only be operated in a technically flawless and reliable condition. The operator is responsible for trouble-free operation of the instrument.

During the entire duration of use, the user is obliged to determine the compliance of the necessary occupational safety measures with the current valid rules and regulations and also take note of new regulations.

2.5 Safety label on the instrument

The safety approval markings and safety tips on the device must be observed.

2.6 CE conformity

The device fulfills the legal requirements of the applicable EC guidelines. By affixing the CE marking, we confirm successful testing of the product.

2.7 Fulfillment of NAMUR recommendations

The device fulfills the requirements of the applicable NAMUR recommendations.

2.8 Safety instructions for oxygen applications

For instruments in oxygen applications the special instructions in chapters "*Storage and transport*", "*Mounting*" as well as "*Technical data*" under "*Process conditions*"must be noted. Furthermore the valid national regulations, implementation instructions and memorandums of the professional assocations must be noted.

3 Product description

3.1 Configuration

Scope of delivery

The scope of delivery encompasses:

- DPT10 differential pressure transmitter
- Depending on the version, ventilation valves and/or screw plugs (details see chapter "*Dimensions*")
- Optional accessory
- Documentation
  - this operating instructions manual
  - Test certificate for pressure transmitters
  - Operating instructions manual "*Display and adjustment module*" (optional)
  - Ex-specific "*Safety instructions*" (with Ex versions)
  - if necessary, further certificates

Constituent parts

The following illustration shows the components of DPT10:

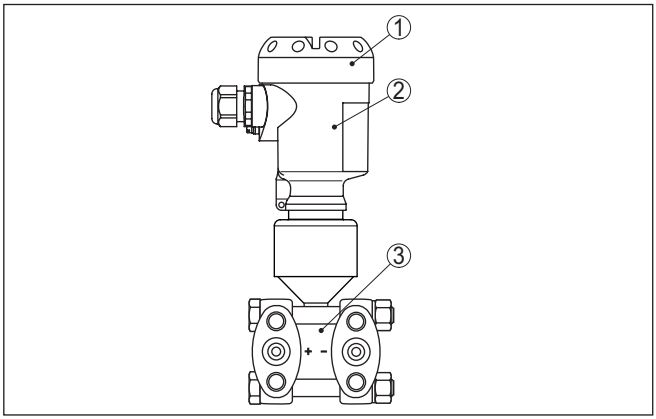


Fig. 1: DPT10 in basic version

1 Housing cover, optionally with integrated display and adjustment module
2 Housing with electronics
3 Process component with measuring cell

The components are available in different versions.

The nameplate contains the most important data for identification and use of the instrument:

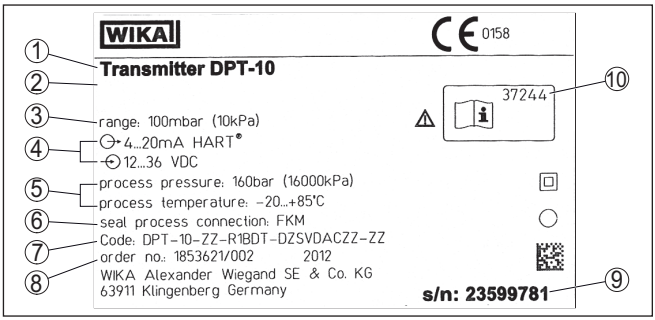


Fig. 2: Layout of the type label (example)

1 Instrument type
2 Field for approvals
3 Measuring range
4 Signal output/Supply voltage
5 Process pressure - Process temperature
6 Seal material
7 Product code
8 Order number
9 Serial number of the instrument
10 ID numbers, instrument documentation

3.2 Principle of operation

Application area

DPT10 is a differential pressure transmitter for measurement of flow, level, differential pressure, density and interface. Measured products are gases, vapours and liquids.

Flow measurement

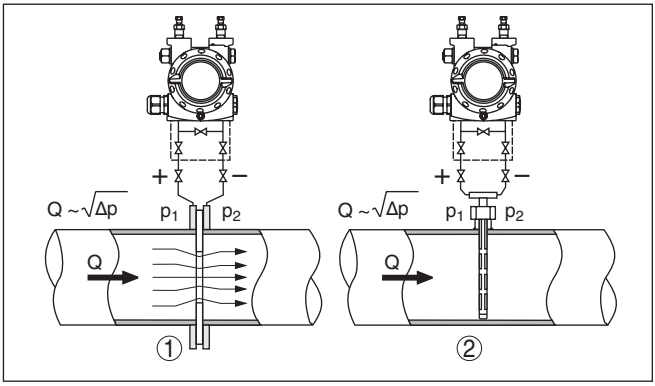


Fig. 3: Flow measurement with DPT10 and DP flow element, Q = flow, Δp = differential pressure, $\Delta p = p_1 - p_2$

1 Orifice
2 Pitot tube

Level measurement

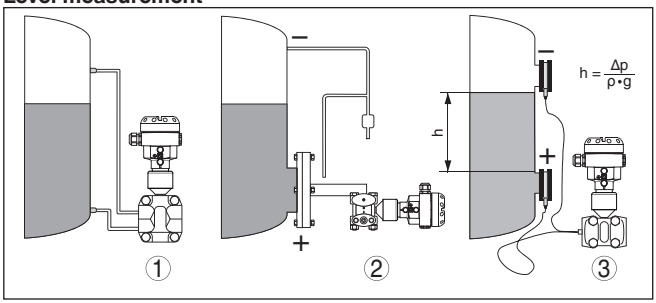


Fig. 4: Level measurement with DPT10. Δp = differential pressure, ρ = density of the medium, g = acceleration of gravity

1 Basic version with effective pressure lines
2 Version with flange chemical seal
3 Version with capillaries and cell chemical seals

Differential pressure measurement

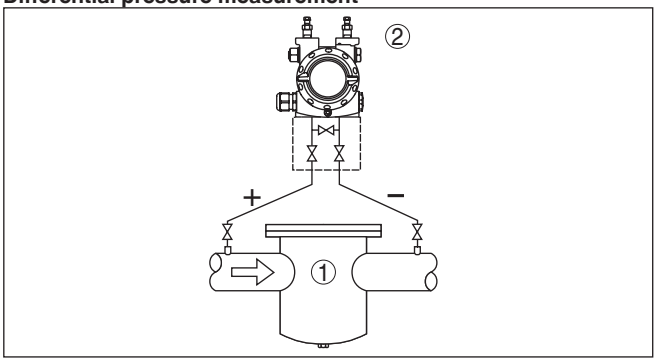


Fig. 5: Differential pressure measurement with DPT10

1 Filter
2 DPT10

Density measurement

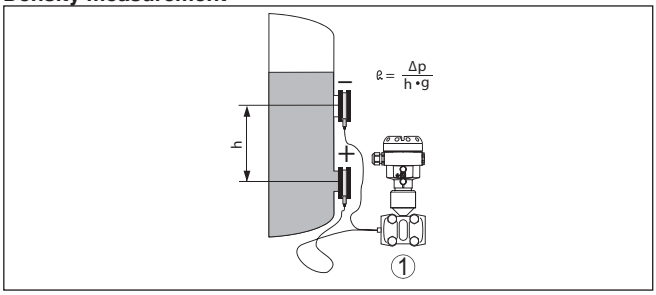


Fig. 6: Density measurement with DPT10, h = defined mounting distance, Δp = differential pressure, ρ = density of the medium, g = acceleration of gravity

1 DPT10

Interface measurement

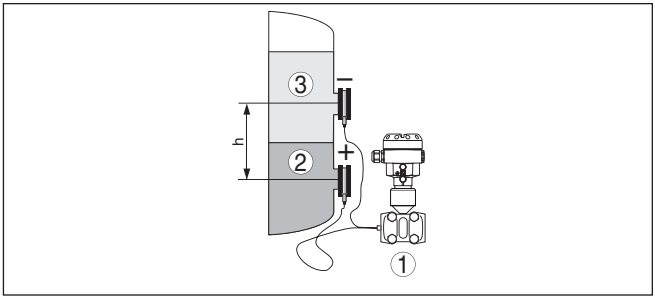


Fig. 7: Interface measurement with DPT10

1 DPT10
2 Liquid with higher density
3 Liquid with lower density

Functional principle

A metallic measuring cell is used as sensor element. The process pressures are transmitted via the separating diaphragms and filling oils to a resistance measuring bridge (semi-conductor technology).

The difference between the acting pressures generates a change in the bridge voltage. This change is measured, further processed and converted into a corresponding output signal.

The markings "**+**" and "**-**" on the process component in chapter "*Mounting and connection instructions*" must therefore be noted when connecting to the process. The pressure acting on "**+**" goes positive, the pressure acting on "**-**" goes negative into the calculation of the pressure difference.

The configuration of the measuring cells differs depending on the measuring range:

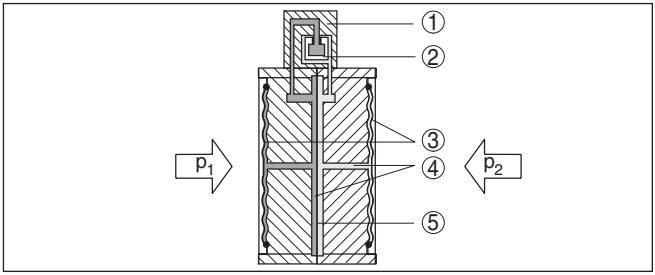


Fig. 8: Metallic measuring cell 10 mbar and 30 mbar - p_1 and p_2 process pressures

1 Measuring element
2 Silicone diaphragm
3 Separating diaphragm
4 Filling oil
5 Integrated overvoltage arrester

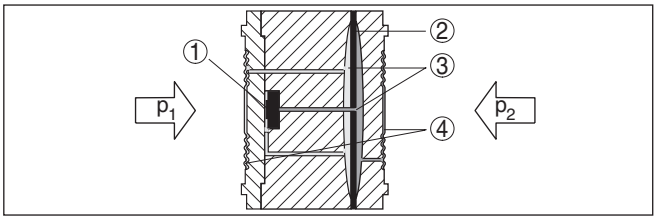


Fig. 9: Metallic measuring cell from 100 mbar - p_1 and p_2 process pressures

1 Measuring element
2 Overload diaphragm/Middle diaphragm
3 Filling oil
4 Separating diaphragm

Power supply and bus communication

Power is supplied via the H1 Fieldbus. A two-wire cable according to Fieldbus specification serves as carrier of both power and digital data for multiple sensors. This cable can be operated in two versions:

- via an H1 interface card in the control system and additional power supply
- via a Linking device with HSE (High speed Ethernet) and additional power supply according to IEC 61158-2

DD/CFF

The DD (Device Descriptions) and CFF (capability files) necessary for planning and configuration of your FF (Foundation Fieldbus) communication network are available in the download area of the WIKA homepage www.wika.com under "*Services*". The appropriate certificates are also available there. A CD with the appropriate files and certificates can be ordered by phone from one of the WIKA agencies.

The backlight of the display and adjustment module is powered by the sensor. Prerequisite is a certain level of operating voltage.

The data for power supply are specified in chapter "*Technical data*".

3.3 Adjustment

The instrument can be adjusted with the following adjustment media:

- With the display and adjustment module
- a configuration tool

The entered parameters are generally saved in DPT10, optionally also in the indicating/adjustment module.

3.4 Packaging, transport and storage

Packaging

Your instrument was protected by packaging during transport. Its capacity to handle normal loads during transport is assured by a test based on ISO 4180.

The packaging of standard instruments consists of environment-friendly, recyclable cardboard. For special versions, PE foam or PE foil is also used. Dispose of the packaging material via specialised recycling companies.

Caution:
Instruments for oxygen applications are sealed in PE foil and provided with a label "Oxygen! Use no Oil". Remove this foil just before mounting the instrument! See instruction under "*Mounting*".

Transport

Transport must be carried out in due consideration of the notes on the transport packaging. Nonobservance of these instructions can cause damage to the device.

Transport inspection

The delivery must be checked for completeness and possible transit damage immediately at receipt. Ascertained transit damage or concealed defects must be appropriately dealt with.

Storage

Up to the time of installation, the packages must be left closed and stored according to the orientation and storage markings on the outside.

Unless otherwise indicated, the packages must be stored only under the following conditions:

- Not in the open
- Dry and dust free
- Not exposed to corrosive media
- Protected against solar radiation
- Avoiding mechanical shock and vibration

Storage and transport temperature

- Storage and transport temperature see chapter "*Supplement - Technical data - Ambient conditions*"
- Relative humidity 20 … 85 %

4 Mounting

4.1 General instructions to use the instrument

Suitability for the process conditions

Make sure that all parts of the instrument coming in direct contact with the process, especially the sensor element, process seal and process fitting, are suitable for the existing process conditions, such as process pressure, process temperature as well as the chemical properties of the medium.

You can find the specifications in chapter "*Technical data*" and on the nameplate.

Moisture

Use the recommended cables (see chapter "*Connecting to power supply*") and tighten the cable gland.

You can give the instrument additional protection against moisture penetration by leading the connection cable downward in front of the cable entry. Rain and condensation water can thus drain off. This applies mainly to outdoor mounting as well as installation in areas where high humidity is expected (e.g. through cleaning processes) or on cooled or heated vessels.

Ventilation

The ventilation for the electronics housing is realised via a filter element in the vicinity of the cable glands.

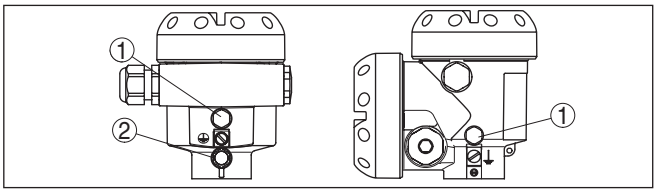


Fig. 10: Position of the filter element with single and double chamber housing

1 Filter element for ventilation of the electronics housing
2 Blind plug

Information:
Make sure that the filter element is always free of buildup during operation. A high-pressure cleaner may not be used for cleaning.

Effective pressure transmitter

DP flow elements are calculated for certain pipeline and operating data. Therefore, check the pipeline data before installation at the measuring point and compare the measurement loop number.

Detailed instructions for mounting the DP flow element are stated in DIN EN ISO 5167 as well as in the instrument documentation from the respective manufacturer.

Effective pressure lines

You will find general recommendations for the installation of effective pressure lines in the corresponding national or international standards. When installing effective pressure lines outdoors, consider applying suitable anti-freeze protection, e.g. tube heating. Install effective pressure lines with a monotonic downward slope of at least 10 %.

Vibrations

In case of strong vibrations at the application position, the instrument version with external electronics should be used.

Temperature limits

Higher process temperatures often mean also higher ambient temperatures for electronics and connection cable. Make sure that the upper temperature limits stated in chapter "*Technical data*" for the environment of the electronics housing and connection cable are not exceeded.

4.2 Instructions for oxygen applications

Oxygen applications

Oxygen and other gases can be explosive when brought into contact with oils, grease and plastics, so the following measures must also be taken:

- All components of the plant, such as e.g. measuring instruments must be cleaned according to the requirements of BAM (DIN 19247)
- Depending on the seal material, certain temperatures and pressures must not be exceeded in oxygen applications, see chapter "*Technical data*"

Danger:
Instruments for oxygen applications must be unpacked just before mounting. After removing the protective cover of the process fitting, the label "O_2" will be visible on the process fitting. Penetration of oil, grease and dirt should be avoided. Danger of explosion!

4.3 Mounting and connection instructions

Connection plus/minus side

When connecting the DPT10 to the measurement loop, take note of the plus/minus side of the process component. The plus side is marked with a "**+**", the minus side with a "**-**" on the process component next to the oval flanges.

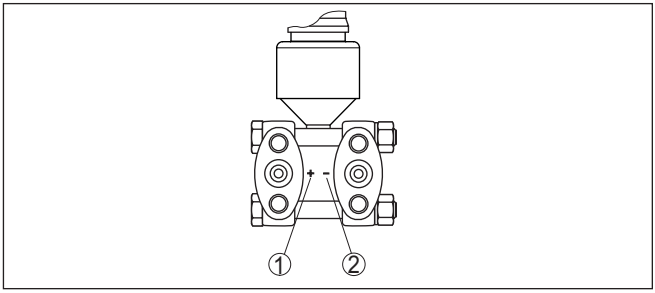


Fig. 11: Marking for plus/minus side on the process component

1 Plus side
2 Minus side

Mounting arrangement

The following illustration shows the elements for a tube mounting and an example for a mounting arrangement with valve block.

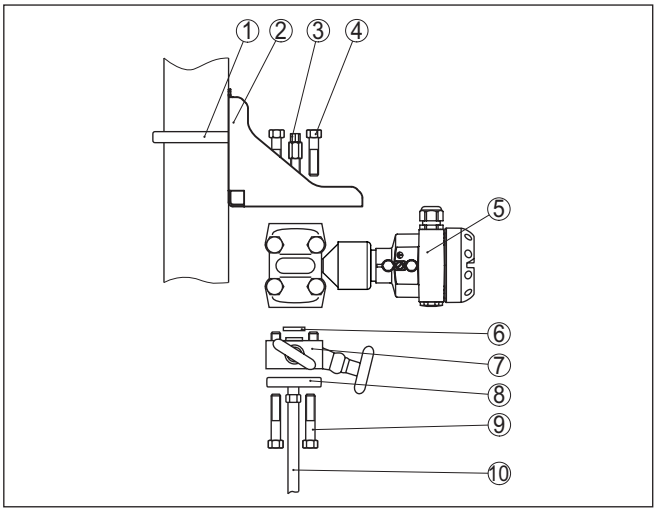


Fig. 12: Mounting arrangement with tube mounting

1 Strap for tube mounting
2 Mounting bracket
3 Ventilation valve
4 Fixing screws
5 DPT10
6 PTFE seal
7 Valve block
8 Oval flange adapter
9 Fixing screws
10 Effective pressure line

Valve blocks

Valve blocks enable the simple installation and setup of the differential pressure transmitter. They separate the pressure transmitter from the process side and enable also a check of the measurement loop. They are available as 3-fold and 5-fold version. The integrated equalization valve enables a pressure compensation between plus and minus side during the setup. Thanks to the valve block it is possible to dismount the DPT10 without interrupting the process. This means higher plant availability and simpler setup or maintenance.

The 3-fold valve block with flanging on both sides enables a mechanically stable connection between the DPT10 and e.g. the tapping points or the flange plate of a pitot tube. With the five-fold valve block, two additional valves allow blowing out the process lines or checking the DPT10 in installed condition.

Connect 3-fold valve block

The following illustration shows the connection of the 3-fold valve block.

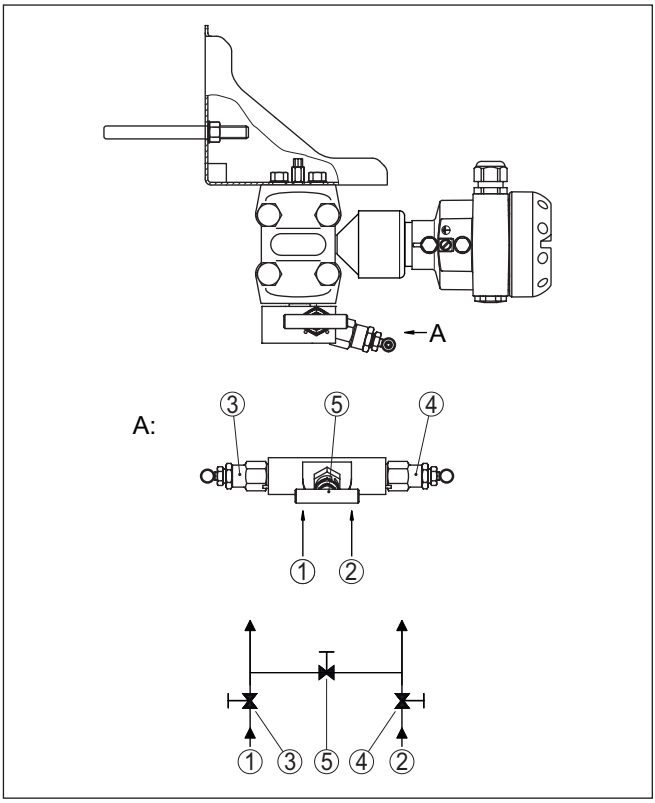


Fig. 13: Connection of a 3-fold valve block

1 Process fitting
2 Process fitting
3 Inlet valve
4 Inlet valve
5 Breather valve

3-fold valve block, flanging on both sides

The following illustration shows the connection of the 3-fold valve block, flanging on both sides.

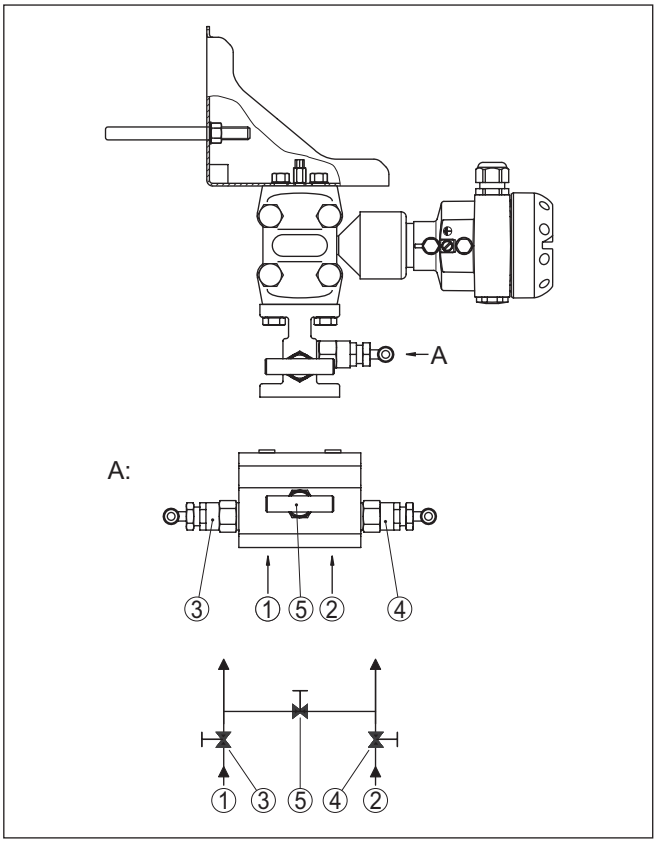


Fig. 14: Connection of a 3-fold valve block, flanging on both sides

1 Process fitting
2 Process fitting
3 Inlet valve
4 Inlet valve
5 Breather valve

5-fold valve block

The following illustration shows the connection of the 5-fold valve block.

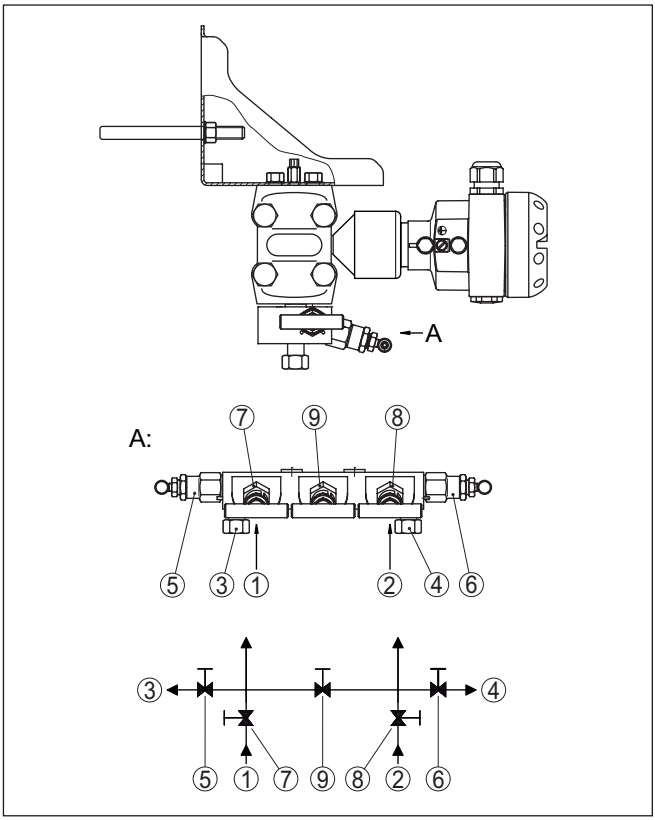


Fig. 15: Connection of a 5-fold valve block

1 Process fitting
2 Process fitting
3 Check/Ventilate
4 Check/Ventilate
5 Valve for checking/ventilating
6 Valve for checking/ventilating
7 Inlet valve
8 Inlet valve
9 Breather valve

4.4 Measurement setup flow

In gases

→ Mount DPT10 above the measurement loop so that condensate can drain off in the process cable.

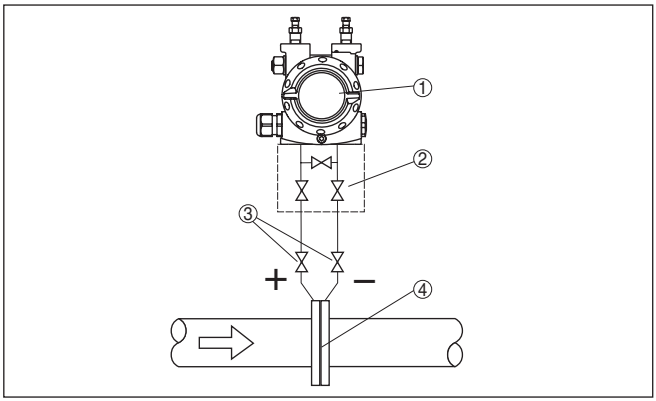


Fig. 16: Measurement setup with flow measurement of gases, connection via 3-fold valve block

1 DPT10
2 3-fold valve block
3 Blocking valves
4 Orifice or impact pressure probe

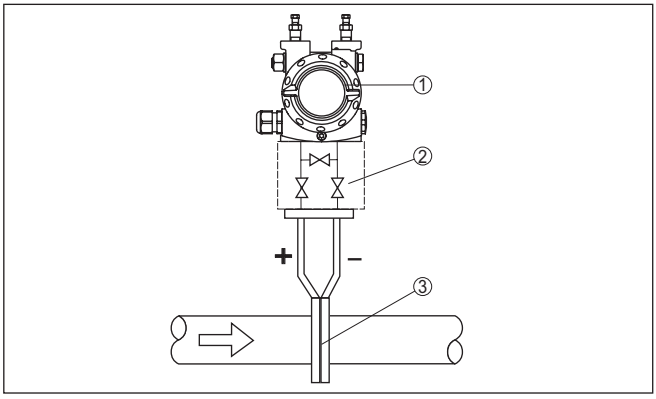


Fig. 17: Measurement setup with flow measurement of gases, connection via 3-fold valve block, flanging on both sides

1 DPT10
2 3-fold valve block, flanging on both sides
3 Orifice or impact pressure probe

In vapours

1. Mount DPT10 below the measurement loop
2. Mount condensate vessels at the same height with the discharge socket and at the same distance to DPT10
3. Fill the effective pressure lines to the height of the condensate vessels before setup

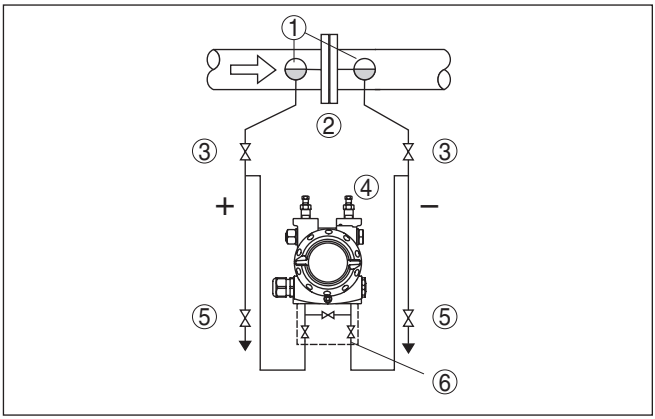


Fig. 18: Measurement setup, flow measurement in vapours

1 Condensate vessels
2 Orifice or impact pressure probe
3 Blocking valves
4 DPT10
5 Drain or blow-off valves
6 3-fold valve block

When using a 5-fold valve block, the drain or blow-off valves are already integrated.

In liquids

1. Mount DPT10 below the measurement loop so that the effective pressure lines are always filled with liquid and gas bubbles can bubble up to the process line
2. For measurements in products with solid content such as e.g. dirty liquids, the installation of separators and drain valves is recommended to enable collection and removal of debris and sediment.
3. Fill the effective pressure lines to the height of the condensate vessels before setup

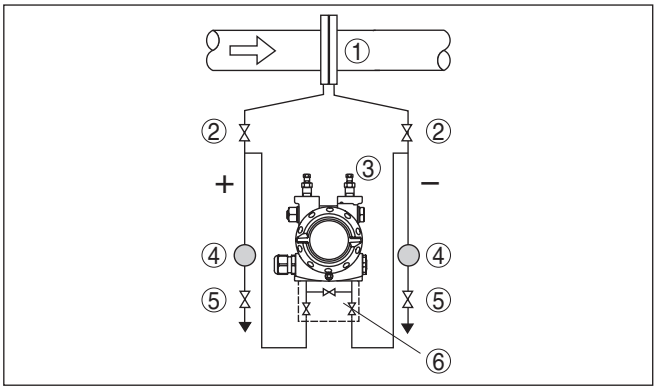


Fig. 19: Measurement setup, flow measurement in liquids

1 Orifice or impact pressure probe
2 Blocking valves
3 DPT10
4 Precipitator
5 Drain valves
6 3-fold valve block

4.5 Measurement setup level

In open vessels with effective pressure line

1. Mount DPT10 below the lower measurement connection so that the effective pressure lines are always filled with liquid
2. Minus side is open to the atmospheric pressure
3. When measuring liquids with solid content, the mounting of separators and drain valves is useful to be able to avoid and remove buildup.

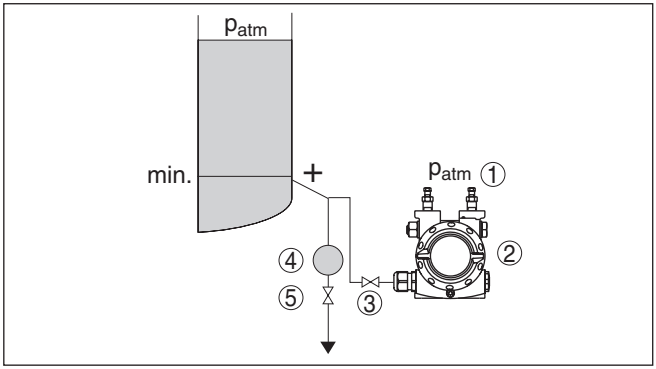


Fig. 20: Measurement setup, level measurement in the open vessel

1 DPT10
2 Minus side is open to the atmospheric pressure
3 Blocking valve
4 Precipitator
5 Drain valve

In open vessels with single chemical seal

1. Mount DPT10 directly to the vessel
2. Minus side is open to the atmospheric pressure

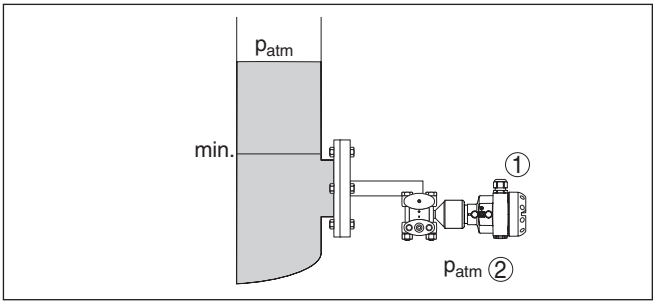


Fig. 21: Measurement setup, level measurement in the open vessel

1 DPT10
2 Minus side is open to the atmospheric pressure

In closed vessels with effective pressure lines

1. Mount DPT10 below the lower measurement connection so that the effective pressure lines are always filled with liquid
2. Connect minus side always above the max. level
3. For measurements in products with solid content such as e.g. dirty liquids, the installation of separators and drain valves is recommended to enable collection and removal of debris and sediment.

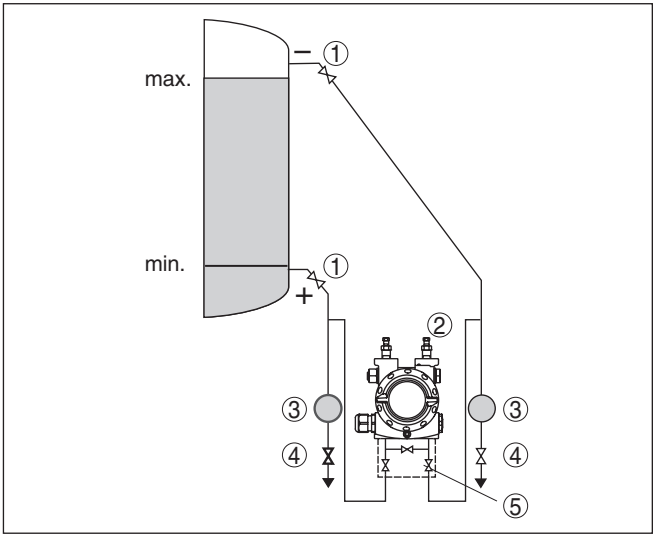


Fig. 22: Measurement setup, level measurement in closed vessel

1 Blocking valves
2 DPT10
3 Precipitator
4 Drain valves
5 3-fold valve block

In closed vessels with single chemical seal

1. Mount DPT10 directly to the vessel
2. Connect minus side always above the max. level
3. For measurements in products with solid content such as e.g. dirty liquids, the installation of separators and drain valves is recommended to enable collection and removal of debris and sediment.

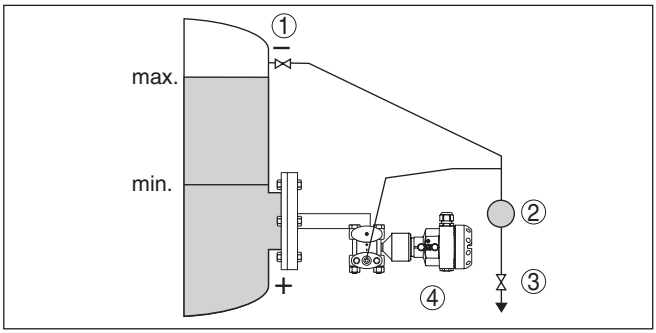


Fig. 23: Measurement setup, level measurement in closed vessel

1 Blocking valve
2 Precipitator
3 Drain valve
4 DPT10

In closed vessels with double chemical seal

1. Mount DPT10 below the lower chemical seal
2. The ambient temperature should be the same for both capillaries

Information:
Level measurement is only ensured between the upper edge of the lower and the lower edge of the upper chemical seal.

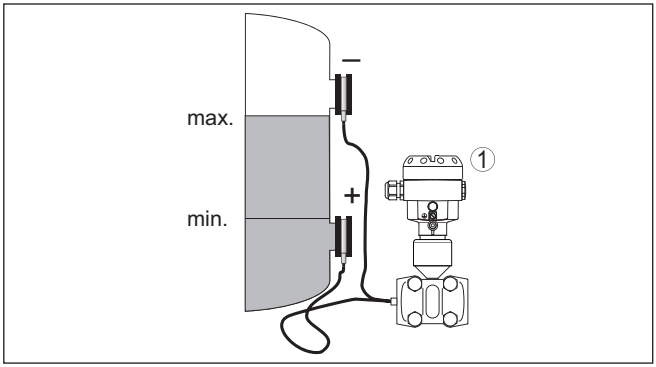


Fig. 24: Measurement setup, level measurement in closed vessel

1 DPT10

In closed vessels with steam layering with effective pressure line

1. Mount DPT10 below the lower measurement connection so that the effective pressure lines are always filled with liquid
2. Connect minus side always above the max. level

3. The condensate vessel ensures a constant pressure on the minus side
4. For measurements in products with solid content such as e.g. dirty liquids, the installation of separators and drain valves is recommended to enable collection and removal of debris and sediment.

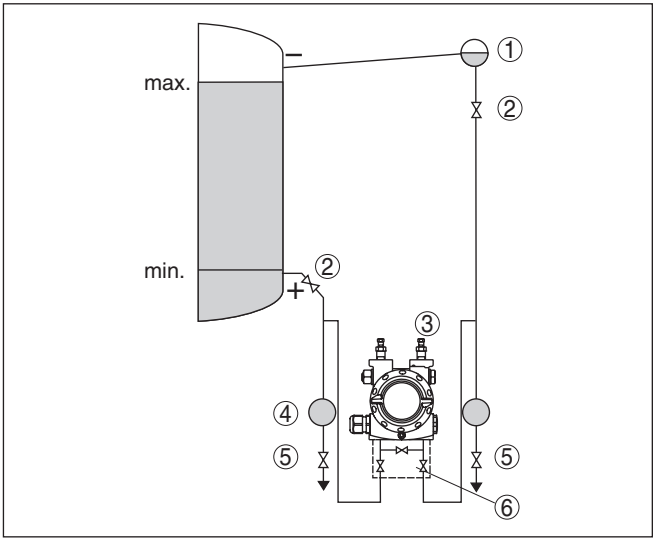


Fig. 25: Measurement setup in closed vessel with superimposed steam

1 Condensate vessel
2 Blocking valves
3 DPT10
4 Precipitator
5 Drain valves
6 3-fold valve block

In closed vessels with superimposed steam with single chemical seal

1. Mount DPT10 directly to the vessel
2. Connect minus side always above the max. level
3. The condensate vessel ensures a constant pressure on the minus side
4. For measurements in products with solid content such as e.g. dirty liquids, the installation of separators and drain valves is recommended to enable collection and removal of debris and sediment.

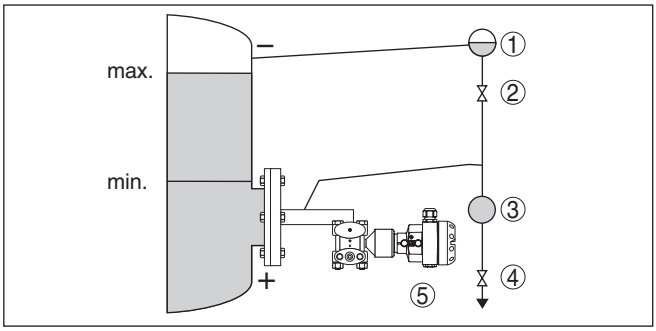


Fig. 26: Measurement setup in closed vessel with superimposed steam

1 Condensate vessel
2 Blocking valve
3 Precipitator
4 Drain valve
5 DPT10

4.6 Measurement setup density and interface

Density measurement

In a vessel with varying level and homogeneous density distribution, density measurement with a differential pressure transmitter can be realized. The connection to the vessel is made via a chemical seal on two measuring points. To reach a high accuracy, the distance between these points must be as big as possible. The density measurement is only ensured with a level above the upper measuring point. If the level drops below the upper measuring point, the density measurement is interrupted.

This density measurement functions with open but also with closed vessels. Make sure that small density changes cause only small changes to the measured differential pressure. Select a suitable measuring range.

The density measurement is carried out in the mode level measurement.

1. Mount DPT10 below the lower chemical seal
2. The ambient temperature should be the same for both capillaries

Example for a density measurement:

Distance between the two measurement points: 0.3 m

Min. density: 1000 kg/m^3

Max. density: 1200 kg/m^3

Measured differential pressure: $\Delta p = \rho \bullet g \bullet h$

The min. adjustment is carried out for the differential pressure measured at density 1.0:

$\Delta p = \rho \bullet g \bullet h$

$= 1000\ kg/m^3 \bullet 9.81\ m/s^2 \bullet 0{,}3\ m$

$= 2943\ Pa = 29.43\ mbar$

The max. adjustment is carried out for the differential pressure measured at density 1.2:

$\Delta p = \rho \bullet g \bullet h$

$= 1200\ kg/m^3 \bullet 9.81\ m/s^2 \bullet 0.3\ m$

$= 3531\ Pa = 35.31\ mbar$

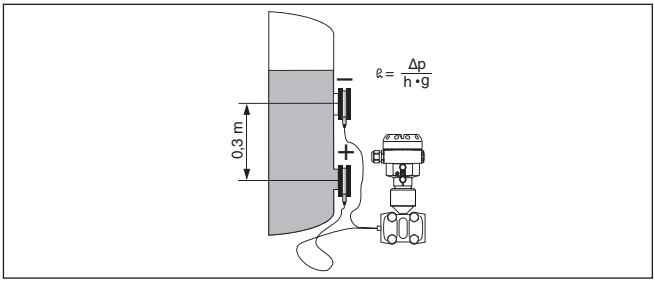


Fig. 27: Measurement setup with density measurement

Interface measurement

In a vessel with varying level, an interface measurement with a differential pressure transmitter can be realized. The connection on the vessel is carried out via a chemical seal on two measuring points. An interface measurement is only possible if the densities of the two products remain the same and the interface is always between the two measuring points. The total level must always be above the upper measuring point.

This density measurement functions with open but also with closed vessel.

Example for an interface measurement:

Distance between the two measurement points: 0.3 m

Min. density: 800 kg/m³

Max. density: 1000 kg/m³

The min. adjustment is carried out for the differential pressure occuring with density 0.8:

$\Delta p = \rho \bullet g \bullet h$

$= 800\ kg/m^3 \bullet 9.81\ m/s \bullet 0.3\ m$

$= 2354\ Pa = 23.54\ mbar$

The max. adjustment is carried out for the differential pressure occuring with density 1.0:

$\Delta p = \rho \bullet g \bullet h$

$= 1000\ kg/m^3 \bullet 9.81\ m/s \bullet 0.3\ m$

$= 2943\ Pa = 29.43\ mbar$

3. Mount DPT10 below the lower chemical seal
4. The ambient temperature should be the same for both capillaries

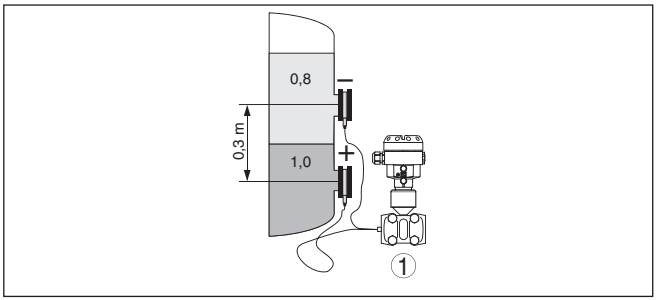


Fig. 28: Measurement setup with interface measurement

4.7 Measurement setup differential pressure

In gases and vapours

→ Mount DPT10 above the measurement loop so that condensate can drain off in the process cable.

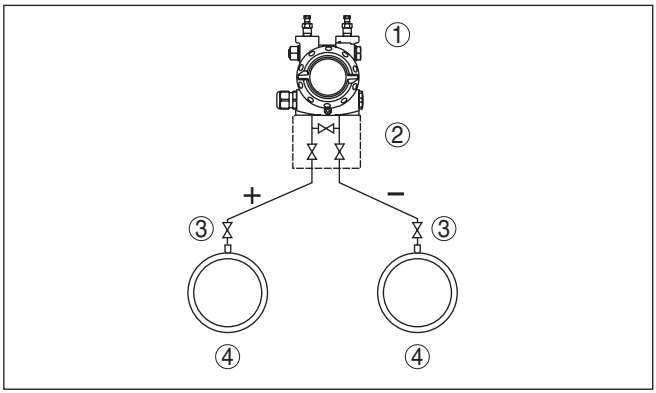


Fig. 29: Measurement setup with differential pressure measurement between two pipelines in gases and vapours

1 DPT10
2 3-fold valve block
3 Blocking valves
4 Pipelines

In vapour and condensate plants

→ Mount DPT10 below the measurement loop so that some condensate can collect in the effective pressure lines.

The ventilation is carried out via the ventilation valves on the instrument, the 5-fold valve block enables blowing out the cables.

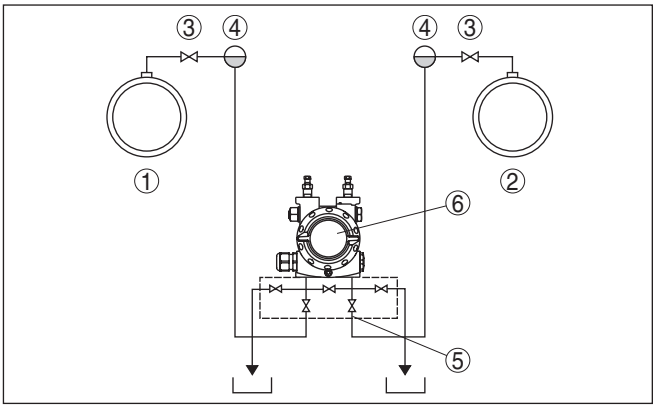


Fig. 30: Measurement setup with differential pressure measurement between a vapour and a condensate cable

1 Vapour cable
2 Condensate cable
3 Blocking valves
4 Condensate vessels
5 5-fold valve block
6 DPT10

In liquids

1. Mount DPT10 below the measurement loop so that the effective pressure lines are always filled with liquid and gas bubbles can bubble up to the process line
2. For measurements in products with solid content such as e.g. dirty liquids, the installation of separators and drain valves is recommended to enable collection and removal of debris and sediment.

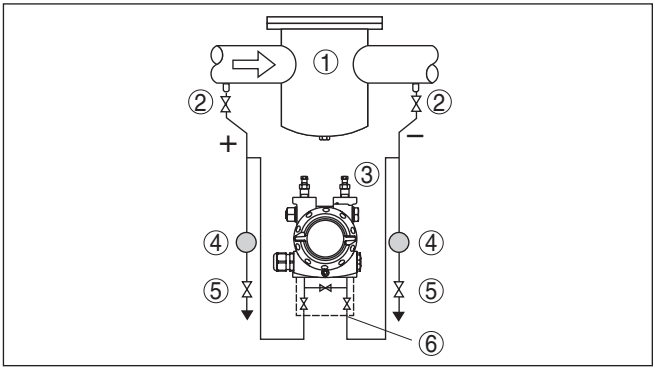


Fig. 31: Measurement setup, flow measurement in liquids

1 E.g. filter
2 Blocking valves
3 DPT10
4 Precipitator
5 Drain valves
6 3-fold valve block

When chemical seal systems are used in all products

1. Mount chemical seal with capillaries on top or laterally on the pipeline
2. In vacuum applications: Mount DPT10 below the measurement loop
3. The ambient temperature should be the same for both capillaries

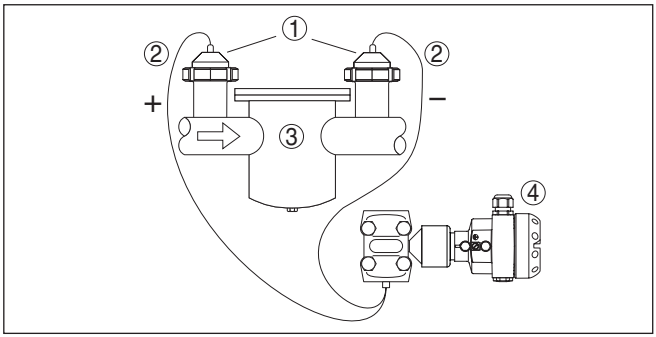


Fig. 32: Measurement setup, differential pressure measurement in gases, vapours and liquids

1 Chemical seal with bolting
2 Capillaries
3 E.g. filter
4 DPT10

4.8 Mounting external housing

1. Mark the holes according to the following drilling template
2. Depending on the mounting surface, fasten the wall mounting plate with 4 screws

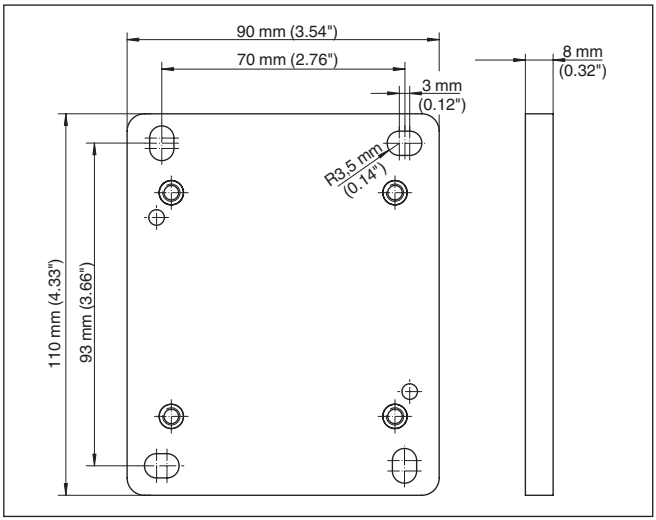


Fig. 33: Drilling template - wall mounting plate

Mount the wall mounting plate so that the cable entry of the socket housing points downward. The socket housing can be displaced by 180° to the wall mounting plate.

4.9 Installation control

Check the following after mounting the instrument:

- Did you tighten all screws?
- Closing screws and ventilation valves closed

5 Connecting to power supply

5.1 Preparing the connection

Note safety instructions

Always keep in mind the following safety instructions:

- Connect only in the complete absence of line voltage
- If overvoltage surges are expected, overvoltage arresters should be installed according to Fieldbus specifications

Take note of safety instructions for Ex applications

In hazardous areas you must take note of the respective regulations, conformity and type approval certificates of the sensors and power supply units.

Select power supply

DPT10 requires a supply voltage of 9 … 24 V DC. Supply voltage and the digital bus signal are carried on the same two-wire connection cable. Power is supplied via the H1 power supply.

Select connection cable

DPT10 is connected with screened cable according to Fieldbus specification.

Use cable with round cross-section. A cable outer diameter of 5 … 9 mm (0.2 … 0.35 in) ensures the seal effect of the cable gland. If you are using cable with a different diameter or cross-section, exchange the seal or use a suitable cable gland.

Make sure that the entire installation is carried out according to the Fieldbus specification. In particular, make sure that the bus is terminated with suitable terminating resistors.

Cable screening and grounding

With systems with potential equalisation, connect the cable screen directly to ground potential at the power supply unit, in the connection box and at the sensor. The screen in the sensor must be connected directly to the internal ground terminal. The ground terminal outside on the housing must be connected to the potential equalisation (low impedance).

In systems without potential equalisation, connect the cable screen directly to ground potential at the power supply unit and at the sensor. In the connection box or T-distributor, the screen of the short stub to the sensor must not be connected to ground potential or to another cable screen. The cable screens to the power supply unit and to the next distributor must be connected to each other and also connected to ground potential via a ceramic capacitor (e.g. 1 nF, 1500 V). The low frequency potential equalisation currents are thus suppressed, but the protective effect against high frequency interference signals remains.

The total capacitance of the cable and of all capacitors must not exceed 10 nF in Ex applications.

Select connection cable for Ex applications

Take note of the corresponding installation regulations for Ex applications. In particular, make sure that no potential equalisation currents flow over the cable screen. In case of grounding on both sides this can be achieved by the use of a capacitor or a separate potential equalisation.

5.2 Connection procedure

Single/Double chamber housing

Proceed as follows:

1. Unscrew the housing cover
2. If a display and adjustment module is installed, remove it by turning it to the left.
3. Loosen compression nut of the cable entry
4. Remove approx. 10 cm of the cable mantle, strip approx. 1 cm insulation from the individual wires
5. Insert the cable into the sensor through the cable entry
6. Lift the opening levers of the terminals with a screwdriver (see following illustration)
7. Insert the wire ends into the open terminals according to the wiring plan
8. Press down the opening levers of the terminals, you will hear the terminal spring closing
9. Check the hold of the wires in the terminals by lightly pulling on them
10. Connect the screen to the internal ground terminal, connect the outer ground terminal to potential equalisation
11. Tighten the compression nut of the cable entry. The seal ring must completely encircle the cable
12. Screw the housing cover back on

The electrical connection is hence finished.

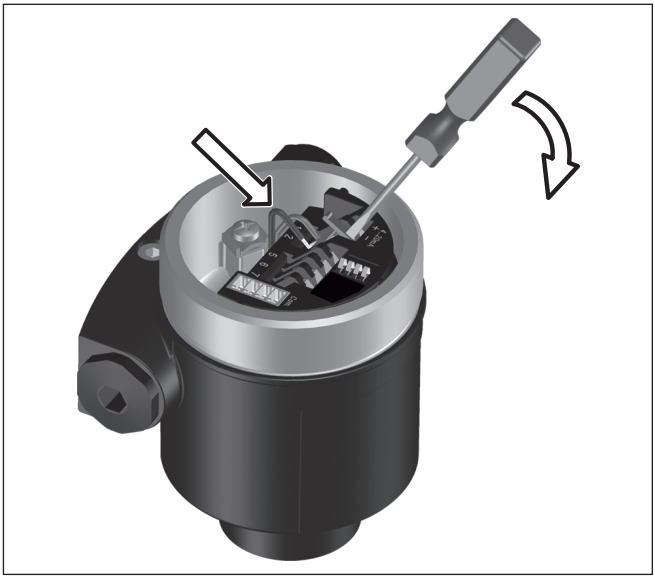


Fig. 34: Connection steps 6 and 7

5.3 Single chamber housing

The following illustrations apply to the non-Ex as well as to the Ex-ia version.

Electronics and connection compartment

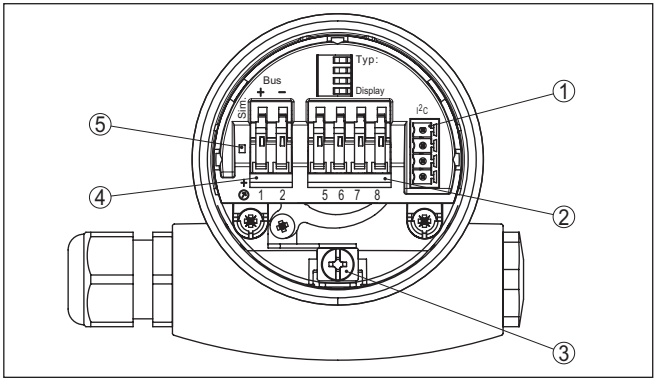


Fig. 35: Electronics and connection compartment, single chamber housing

1 Plug connector for service interface
2 Spring-loaded terminals for connection of the external indication
3 Ground terminal for connection of the cable screen
4 Spring-loaded terminals for Foundation Fieldbus connection
5 Simulation switch ("on" = simulation mode)

Wiring plan

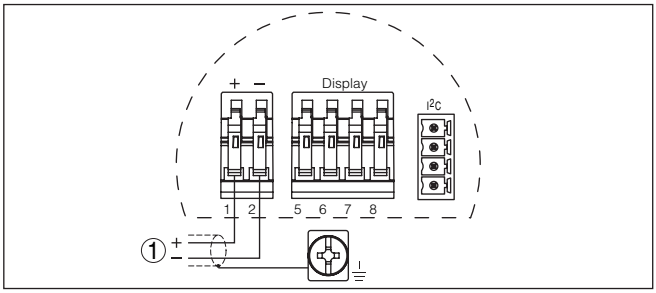


Fig. 36: Wiring plan, single chamber housing

1 Voltage supply, signal output

5.4 Wiring plan, double chamber housing

The following illustrations apply to the non-Ex as well as to the Ex-ia version.

Electronics compartment

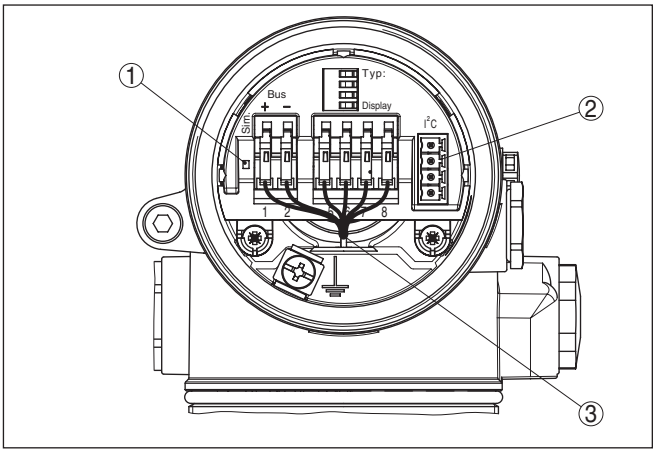


Fig. 37: Electronics compartment, double chamber housing

1 Simulation switch ("on" = simulation mode)
2 Connection for service
3 Internal connection cable to the connection compartment

Connection compartment

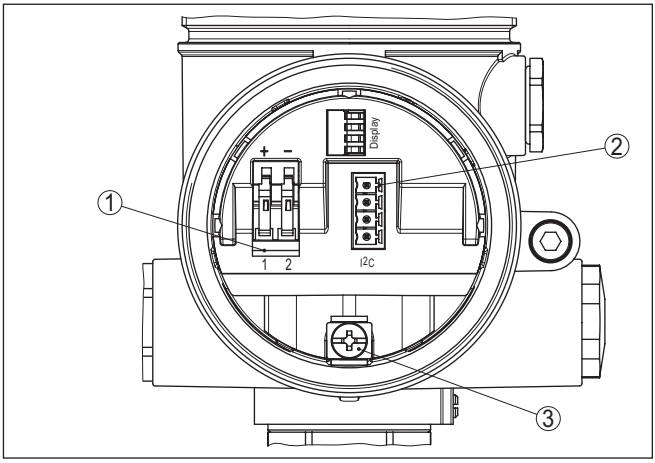


Fig. 38: Connection compartment, double chamber housing

1 Spring-loaded terminals for voltage supply
2 Plug connector for service interface
3 Ground terminal for connection of the cable screen

Wiring plan

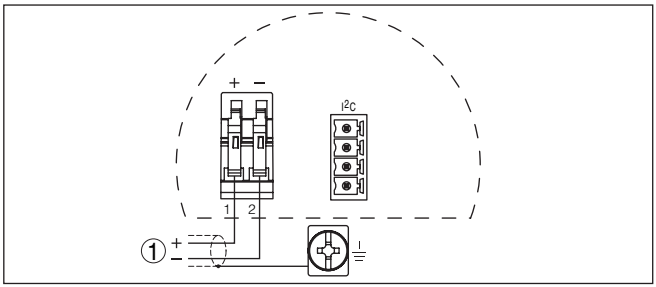


Fig. 39: Wiring plan, double chamber housing

1 Voltage supply, signal output

Plug M12 x 1 for external display and adjustment unit

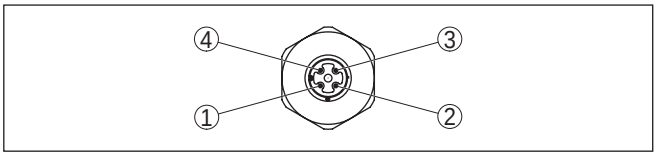


Fig. 40: Top view of the plug connector

1 Pin 1
2 Pin 2
3 Pin 3
4 Pin 4

Contact pin	Colour connection cable in the sensor	Terminal, electronics module
Pin 1	Brown	5
Pin 2	White	6
Pin 3	Blue	7
Pin 4	Black	8

5.5 Double chamber housing Ex d

Electronics compartment

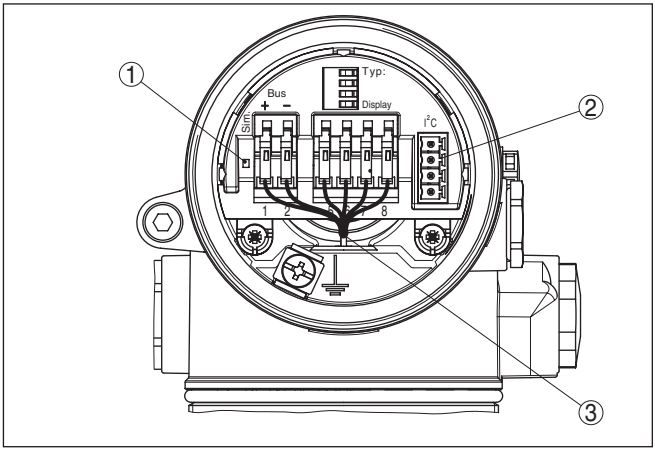


Fig. 41: Electronics compartment, double chamber housing

1 Simulation switch ("on" = simulation mode)
2 Connection for service
3 Internal connection cable to the connection compartment

Connection compartment

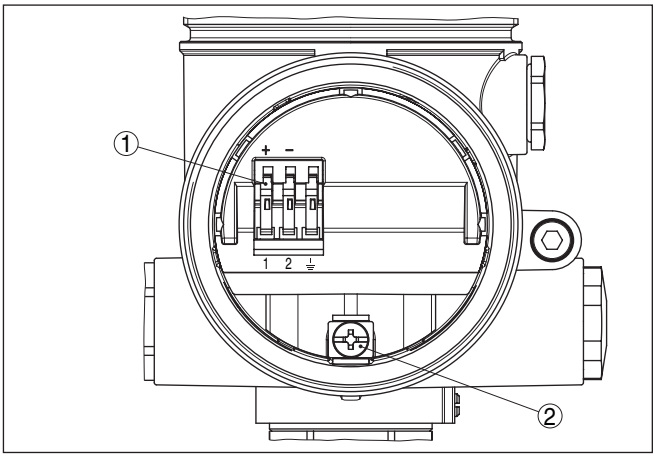


Fig. 42: Connection compartment, Ex-d double chamber housing

1 Spring-loaded terminals for power supply and cable screen
2 Ground terminal for connection of the cable screen

Wiring plan

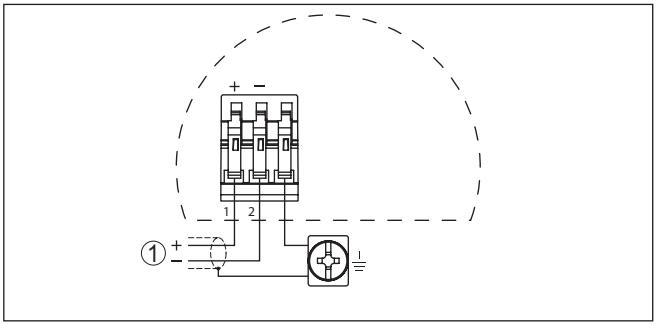


Fig. 43: Wiring plan, Ex-d double chamber housing

1 Voltage supply, signal output

Plug M12 x 1 for external display and adjustment unit

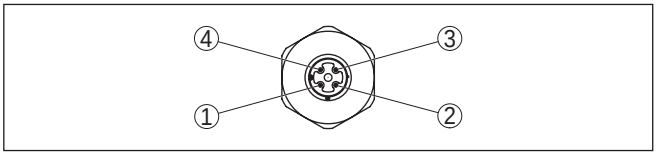


Fig. 44: Top view of the plug connector

1 Pin 1
2 Pin 2
3 Pin 3
4 Pin 4

Contact pin	Colour connection cable in the sensor	Terminal, electronics module
Pin 1	Brown	5
Pin 2	White	6
Pin 3	Blue	7
Pin 4	Black	8

5.6 Version IP 66/IP 68, 1 bar

Wire assignment, connection cable

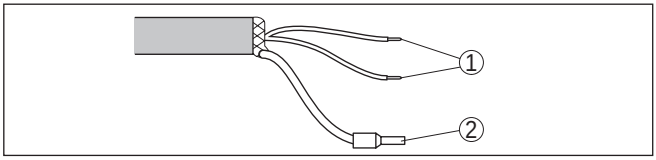


Fig. 45: Wire assignment, connection cable

1 brown (+) and blue (-) to power supply or to the processing system
2 Shielding

5.7 Switch-on phase

Switch-on phase

After DPT10 is connected to voltage supply or after voltage recurrence, the instrument carries out a self-check for approx. 30 seconds. The following steps are carried out:

- Internal check of the electronics
- Indication of the instrument type, the firmware as well as the sensor TAGs (sensor designation)
- Status byte goes briefly to fault value

Then the current measured value will be displayed and the corresponding digital output signal will be outputted to the cable.[1)]

[1)] The values correspond to the actual measured level as well as to the settings already carried out, e.g. default setting.

6 Adjustment with the display and adjustment module

6.1 Short description

Function/Configuration

The display and adjustment module is used for measured value display, adjustment and diagnosis. It can be mounted in the following housing versions and instruments:

- All sensors DPT-10 and IPT-1*, in the single as well as double chamber housing (optionally in the electronics or connection compartment)
- External display and adjustment unit

Note:
You can find detailed information on the adjustment in the operating instructions manual "*Display and adjustment module*".

6.2 Insert display and adjustment module

Mount/Dismount display and adjustment module

The display and adjustment module can be inserted and removed at any time. It is not necessary to interrupt the voltage supply.

For installation, proceed as follows:

1. Unscrew the housing cover
2. Place the display and adjustment module in the desired position on the electronics (you can choose any one of four different positions - each displaced by 90°)
3. Press the display and adjustment module onto the electronics and turn it to the right until it snaps in.
4. Screw housing cover with inspection window tightly back on

Removal is carried out in reverse order.

The display and adjustment module is powered by the sensor, an additional connection is not necessary.

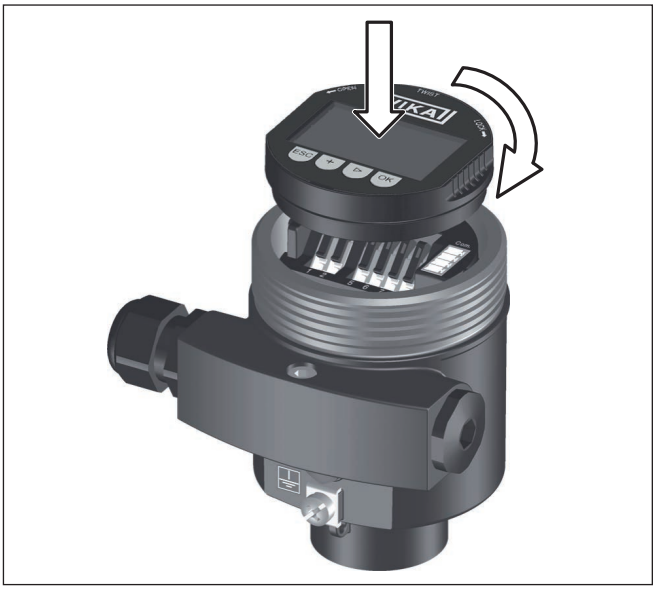


Fig. 46: Insert display and adjustment module

Note:
If you intend to retrofit the instrument with a display and adjustment module for continuous measured value indication, a higher cover with an inspection glass is required.

6.3 Adjustment system

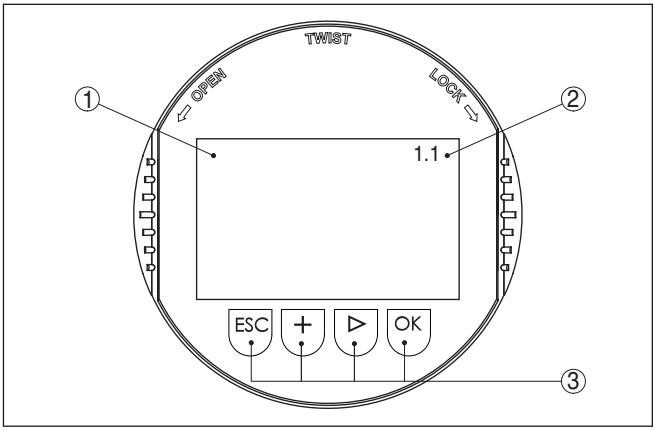


Fig. 47: Display and adjustment elements

1 LC display
2 Indication of the menu item number
3 Adjustment keys

Key functions

- ***[OK]*** key:
  - Move to the menu overview
  - Confirm selected menu
  - Edit parameter
  - Save value
- ***[->]*** key to select:
  - Menu change
  - Select list entry
  - Select editing position
- ***[+]*** key:
  - Change value of the parameter
- ***[ESC]*** key:
  - Interrupt input
  - Jump to next higher menu

Adjustment system

The sensor is adjusted via the four keys of the display and adjustment module. The LC display indicates the individual menu items. The functions of the individual keys are shown in the above illustration. Approx. 10 minutes after the last pressing of a key, an automatic reset to measured value indication is triggered. Any values not confirmed with ***[OK]*** will not be saved.

6.4 Parameter description

Introduction

DPT10 has general adjustment parameters which are also used for other measuring principles as well as instrument-specific adjustment parameters. The general adjustment parameters are described in the operating instructions manual "*Display and adjustment module*".

The instrument-specific adjustment parameters are described in this chapter.

Information:
If the adjustment limits of the adjustment parameters are exceeded, the message "*Outside parameter limits*" appears. The editing procedure can be aborted with ***[ESC]*** or the displayed limit value can be accepted with ***[OK]***.

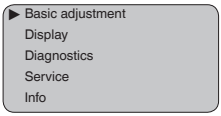
Application

The DPT10 can be used for differential pressure, level, flow as well as density and interface measurement. The selection of the respective application is carried out in the menu item "*Application*". Dependent on the selected application, the adjustment is carried out as zero/span or min./max. adjustment.

Information:
The applications density and interface measurement are also realized via the application level measurement.

Proceed as follows to switch over to the application differential pressure or flow measurement:

1. Push the ***[OK]*** button in the measured value display, the menu overview is displayed.



2. Confirm the menu "*Basic adjustment*" with ***[OK]***.

3. Confirm the menu item "*Application*" with ***[OK]***.

Warning:
Note the warning: "*Output can change*".

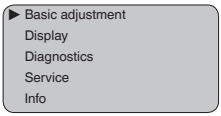
4. Select with ***[->]*** "*OK*" and confirm with ***[OK]***.
5. Select the requested application in the selection list, for example "*Flow*" and confirm with ***[OK]***.

Unit of measurement

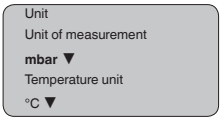
In this menu item you select the adjustment unit as well as the unit for the temperature indication in the display.

To select the adjustment unit (in the example switching over from mbar to bar), proceed as follows:

1. Push the ***[OK]*** button in the measured value display, the menu overview is displayed.



2. Confirm the menu "***Basic adjustment***" with *[OK]*, the menu item "*Unit*" will be displayed.



3. Activate the selection with ***[OK]*** and select "***Units of measurement*** with *[->]*.
4. Activate the selection with ***[OK]*** and select the requested unit with ***[->]*** (in the example bar).
5. Confirm with ***[OK]*** and move to position correction with ***[->]***.

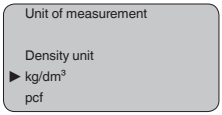
The adjustment unit is thus switched over from mbar to bar.

Information:
When switching over to adjustment in a height unit (for example for level measurement), the density also has to be entered.

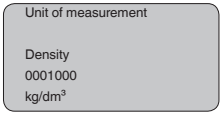
Proceed as follows to enter the density:

1. Push the ***[OK]*** button in the measured value display, the menu overview is displayed.

2. Confirm the menu "***Basic adjustment***" with *[OK]*, the menu item "*Units of measurement*" will be displayed.
3. Activate the selection with ***[OK]*** and select the requested unit with ***[->]*** (in the example m).
4. Confirm with ***[OK]***, the submenu "*Density unit*" appears.



5. Select the requested unit, e.g. kg/dm³ with ***[->]*** and confirm with ***[OK]***, the submenu "*Density*" appears.



6. Enter the requested density value with ***[->]*** and ***[+]***, confirm with ***[OK]*** and move to position correction with ***[->]***.

The adjustment unit is thus switched over from bar to m.

Proceed as follows to select the temperature unit:

1. Activate the selection with ***[OK]*** and select "***Temperature unit*** with *[->]*.
2. Activate the selection with ***[OK]*** and select the requested unit with ***[->]*** (e.g. °F).
3. Confirm with ***[OK]***.

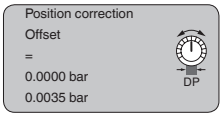
The temperature unit is hence switched over from °C to °F.

Position correction

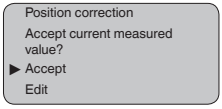
The position correction compensates the influence of the installation position of the instrument on the measured value. In this menu item, the offset value as well as the current measured value are displayed.

Proceed as follows:

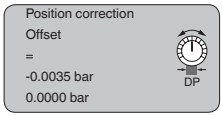
1. Activate in the menu item "*Position correction*" the selection with ***[OK]***.



2. Select with ***[->]***, e.g. to accept the actual measured value 0.0035 bar.



3. Confirm with ***[OK]***.



4. Move to min. (zero) adjustment with ***[->]***.

The current measured value was corrected to 0, the corrective value is available in the display as offset value with sign reversal.

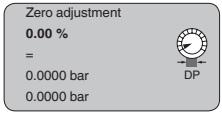
If a known value should be taken over as position correction which is not the current value, then you have to select the function "*Edit*" and enter the requested value.

Zero adjustment with differential pressure

In this menu item, the min. differential pressure is entered.

Proceed as follows:

1. Edit the bar value in the menu item "*zero*" with ***[OK]***.



2. Set the requested value with ***[+]*** and ***[->]***.
3. Confirm with ***[OK]*** and move to span adjustment with ***[->]***.

For an adjustment with pressure, simply enter the actual measured value indicated at the bottom of the display.

The zero adjustment is finished.

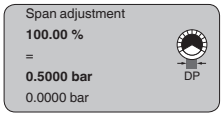
Information:
The zero adjustment shifts the value of the span adjustment. The span, i.e. the difference between these values, however, remains unchanged.

Span adjustment with differential pressure

In this menu item, the max. differential pressure is entered.

Proceed as follows:

1. Edit the bar value in the menu item "*span*" with ***[OK]***.



Information:
If the instrument has not yet been adjusted, the displayed pressure for 100 % corresponds to the nominal measuring range of the sensor (in the above example 500 mbar).

2. Set the requested value with ***[+]*** and ***[->]***.
3. Confirm with ***[OK]*** and move to the menu overview with ***[ESC]***.

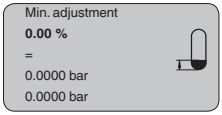
For an adjustment with pressure, simply enter the actual measured value indicated at the bottom of the display.

The span adjustment is finished.

Min. adjustment with level

Proceed as follows:

1. Edit the % value in the menu item "*Min. adjustment*" with ***[OK]***.



2. Set the requested value with ***[+]*** and ***[->]***.
3. Confirm with ***[OK]*** and edit the requested bar value.
4. Set the requested bar value with ***[+]*** and ***[->]***.
5. Confirm with ***[OK]*** and move to max. adjustment with ***[->]***.

For an adjustment with filling, simply enter the actual measured value indicated at the bottom of the display.

The min. adjustment is finished.

Max. adjustment with level

Proceed as follows:

1. Edit the % value in the menu item "*Max. adjustment*" with ***[OK]***.

Information:
If the instrument has not yet been adjusted, the displayed pressure for 100 % corresponds to the nominal measuring range of the sensor (in the above example 500 mbar).

2. Set the requested value with ***[->]*** and ***[OK]***.
3. Confirm with ***[OK]*** and edit the requested mbar value.
4. Set the requested value with ***[+]*** and ***[->]***.
5. Confirm with ***[OK]*** and move to the menu overview with ***[ESC]***.

For an adjustment with filling, simply enter the actual measured value indicated at the bottom of the display.

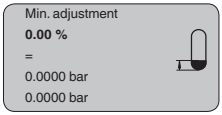
The max. adjustment is finished.

Min. adjustment with density

For the min. adjustment with density, a filling of the vessel is not necessary. The numeric examples are stated in chapter *Mounting*, *Measurement setup, Density and interface* of this instructions manual.

Proceed as follows:

1. Edit the % value in the menu item "*Min. adjustment*" with ***[OK]***.



2. Set the requested value with ***[+]*** and ***[->]***, for example 100 %.
3. Confirm with ***[OK]*** and edit the requested bar value.
4. Set the requested bar value with ***[+]*** and ***[->]***, for example 29.4 mbar.

5. Confirm with ***[OK]*** and move to max. adjustment with ***[->]***.

For an adjustment with filling, simply enter the actual measured value indicated at the bottom of the display.

The min. adjustment is finished.

Max. adjustment with density

For the max. adjustment with density, a filling of the vessel is not necessary. The numeric examples are stated in chapter *Mounting*, *Measurement setup, Density and interface* of this instructions manual.

Proceed as follows:

1. Edit the % value in the menu item "*Max. adjustment*" with ***[OK]***.

Information:
If the instrument has not yet been adjusted, the displayed pressure for 100 % corresponds to the nominal measuring range of the sensor (in the above example 100 mbar).

2. Set the requested value with ***[->]*** and ***[OK]***, for example 0.0 %.
3. Confirm with ***[OK]*** and edit the requested mbar value.
4. Set the requested value with ***[+]*** and ***[->]***, for example 35.3 mbar.
5. Confirm with ***[OK]*** and move to the menu overview with ***[ESC]***.

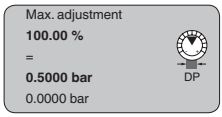
For an adjustment with filling, simply enter the actual measured value indicated at the bottom of the display.

The max. adjustment is finished.

Max. adjustment with flow

Proceed as follows:

1. Edit the bar value in the menu item "*Max. adjustment*" with ***[OK]***.



Information:
If the instrument has not yet been adjusted, the displayed pressure for 100 % corresponds to the nominal measuring range of the sensor (in the above example 500 mbar).

2. Set the requested mbar value with ***[->]*** and ***[OK]***.
3. Confirm with ***[OK]*** and move to the menu overview with ***[ESC]***.

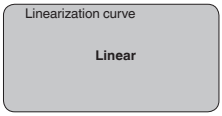
For an adjustment with flow, simply enter the actual measured value indicated at the bottom of the display.

The max. adjustment is finished.

Linearization curve with level

For level measurement, a linearization is necessary for all vessels in which the vessel volume does not increase linearly with the level - e.g. in a cylindrical or spherical tank - and the indication or output of the volume is requested.

Respective linearisation curves are stored for these vessels. They indicate the relation between the percentage level and the vessel volume. By activating the suitable curve, the percentage vessel volume is displayed correctly.



Enter the requested parameters via the appropriate keys, save your settings and jump to the next menu item with the ***[->]*** key.

Caution:
Note the following if the DPT10 with corresponding approval is used as part of an overfill protection system according to WHG (Water Resources Act):

If a linearization curve is selected, the measuring signal is no longer necessarily linear to the filling height. This must be considered by the user especially when adjusting the switching point on the limit signal transmitter.

Leak flow volume suppression with flow

In some application, small flow quantities should not be detected. With the creeping quantity suppression, the flow value can be suppressed up to a certain % value. The default value is 5 % of the max. flow value, corresponding to 0.25 % of the max. differential pressure value. The limit value is 50 %. This function depends on the selected linearization function and is only available with root extracted characteristics.

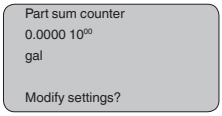
The square root/bidirectional square root characteristics is very steep at the zero point. This means that small changes in the measured differential pressure cause big changes in the output signal. The leak volume suppression stabilises the signal output.

Total amounts counter and subtotalizer with flow

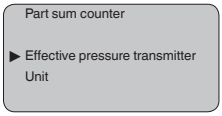
The DPT10 has two internal totalizers. For both you can adjust volume or mass as count function as well as separately the unit.

Proceed as follows:

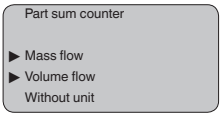
1. Select, for example, menu item "*Part sum counter*".



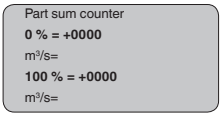
2. Activate the function "*Modify settings?*" with ***[OK]***.



3. Confirm with ***[OK]*** "*Effective pressure transmitter*".



4. Select the requested variable with ***[->]*** and confirm with ***[OK]***.
5. Select calibration unit of the effective pressure transmitter with ***[->]***, for example m^3/s and confirm with ***[OK]***.



6. Edit with ***[OK]*** and set the requested values with ***[+]*** and ***[->]***.
7. Confirm with ***[OK]*** and jump back to the indication of the part sum counter.
8. Select with ***[->]*** the unit of the sum counter, adjust the requested unit with ***[->]***, for example m^3/s and confirm with ***[OK]***.

The setting of the part sum counter is hence terminated, the counting function is activated.

The procedure of the total sum counter is the same.

Copy sensor data

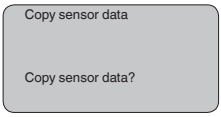
This function enables reading out parameter adjustment data as well as writing parameter adjustment data into the sensor via the display and adjustment module. A description of the function is available in the operating instructions manual "*Display and adjustment module*".

The following data are read out or written with this function:

- Measured value presentation
- Application
- Unit of measurement
- Adjustment
- Damping
- Linearization curve
- Leak flow volume suppression
- Sensor-TAG
- Displayed value
- Display unit
- Language

The following safety-relevant data are **not** read out or written:

- PIN



Reset

Basic adjustment
The reset "*Basic adjustment*" resets the following menu items to the reset values (see chart):

Menu section	Menu item	Reset value
Basic settings	Zero/Min. adjustment	Measuring range begin
	Span/Max. adjustment	Measuring range end
	Density	1 kg/l
	Density unit	kg/l
	Damping	1 s
	Linearization	Linear
	Sensor-TAG	Sensor
Display	Displayed value	AI-Out
Diagnostics	Totalizer	0.0000 10^{00} gal
	Part sum counter	0.0000 10^{00} gal

The values of the following menu items are *not* reset with "**Reset**:

Menu section	Menu item	Reset value
Basic settings	Unit of measurement	bar
	Temperature unit	°C
	Position correction	No reset
Display	Backlight	No reset
Service	Language	No reset
	Application	No reset

Peak value
The min. and max. temperature or pressure values are each reset to the actual value.

Totalizer
The total and part sum counter are reset to zero.

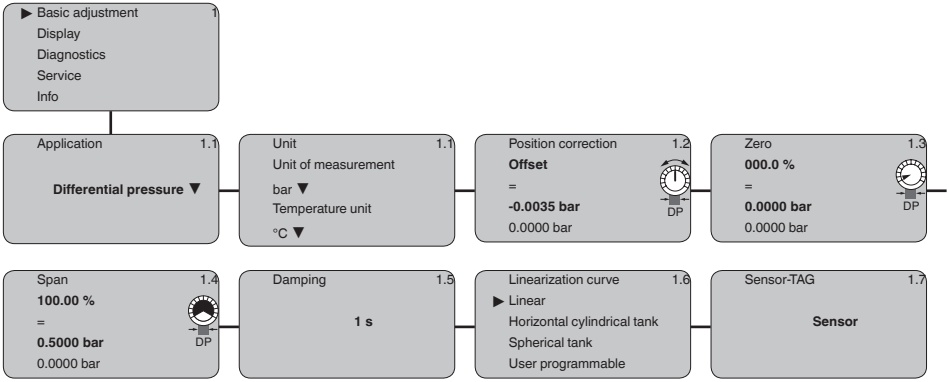
Optional settings

Additional adjustment and diagnosis options such as e.g. scaling, simulation or trend curve presentation are shown in the following menu schematic. You will find a detailed description of these menu items in the operating instructions manual "*Display and adjustment module*".

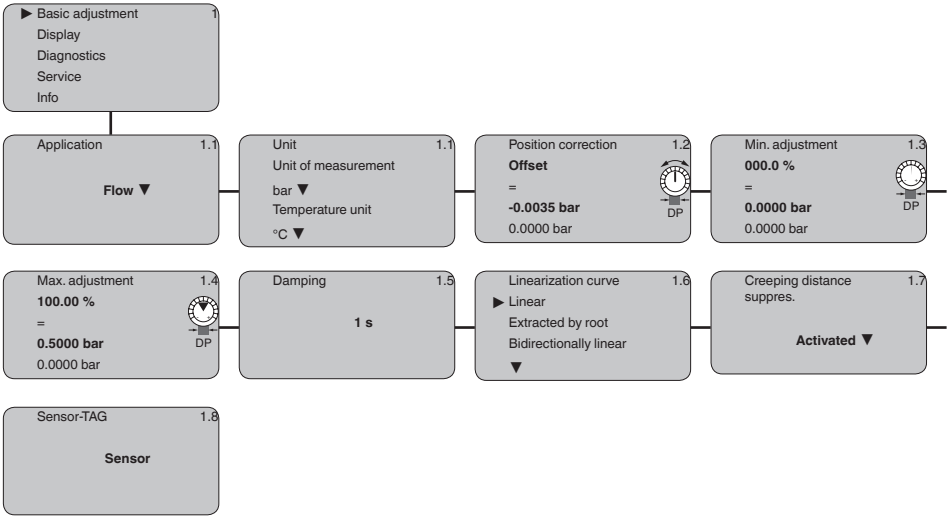
6.5 Menu schematic

Information:
Depending on the version and application, the highlighted menu windows may not always be available.

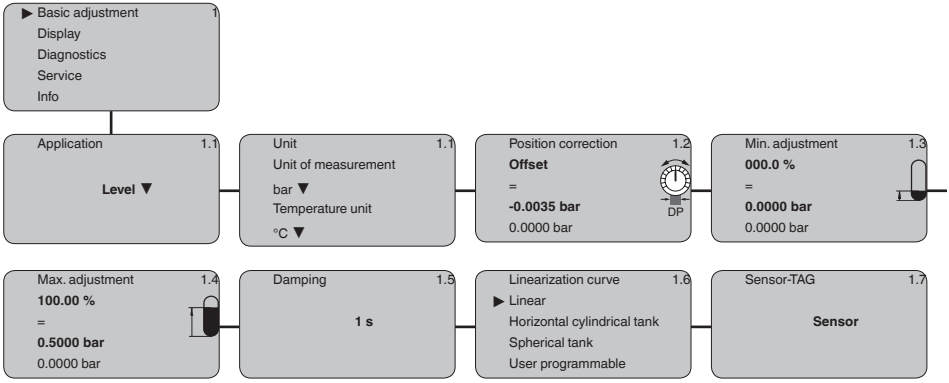
Basic adjustment differential pressure



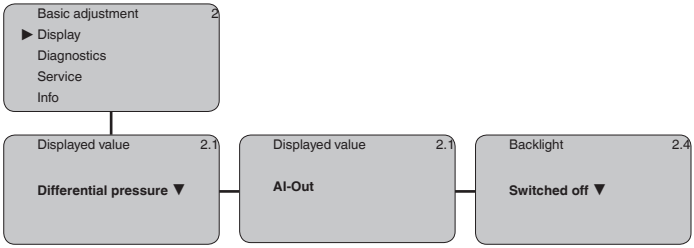
Basic adjustment flow



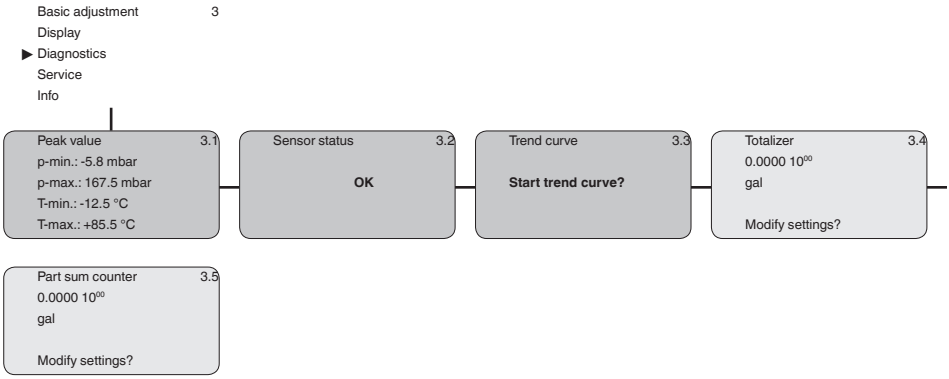
Basic setting level



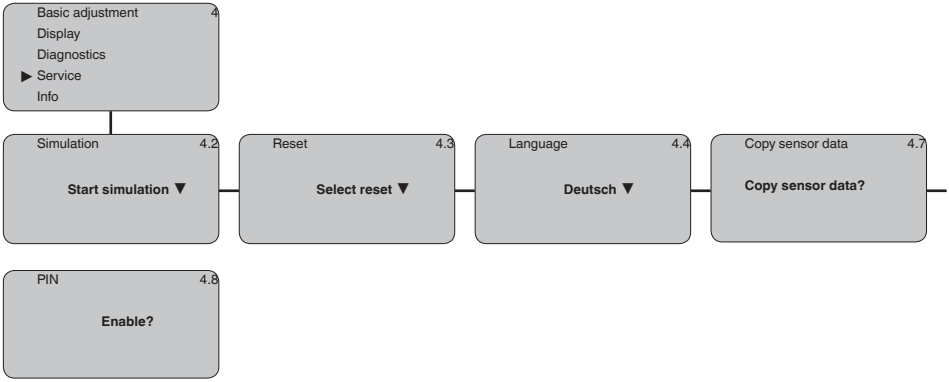
Display



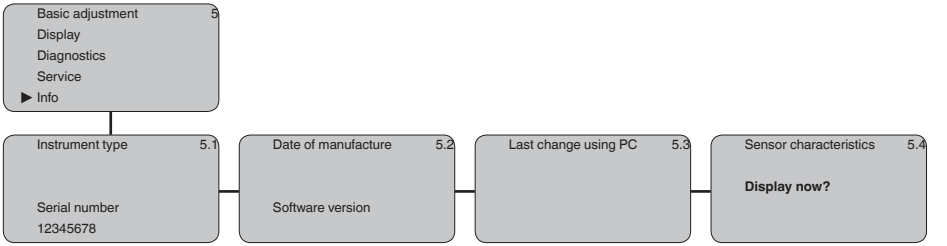
Diagnostics



Service



Info



6.12 Saving the parameter adjustment data

We recommended noting the adjusted data, e.g. in this operating instructions manual, and archiving them afterwards. They are thus available for multiple use or service purposes.

If DPT10 is equipped with a display and adjustment module, the most important data can be read out of the sensor into the display and adjustment module. The procedure is described in the operating instructions manual "*Display and adjustment module*" in the menu item "*Copy sensor data*". The data remain there permanently even if the sensor power supply fails.

If it is necessary to exchange the sensor, the display and adjustment module is inserted into the replacement instrument and the data are written into the sensor under the menu item "*Copy sensor data*".

7 Setup with the adjustment program AMS™

7.1 Parameter adjustment with AMS™

For WIKA sensors, instrument descriptions for the adjustment program AMS™ are available as DD. The instrument descriptions are already implemented in the current version of AMS™. For older versions of AMS™, a free-of-charge download is available via Internet.

Go via www.WIKA.com and "*Downloads*" to the item "*Software*".

8 Setup

8.1 Select the mode

The following operating modes can be set on DPT10:

- Flow measurement
- Level measurement
- Differential pressure measurement

8.2 Flow measurement

Instructions

In flow measurement, DPT10 is normally used without a chemical seal.

Before adjusting DPT10, you have to clean the effective pressure lines and the instrument must be filled with the medium.

Measurement setup for gases

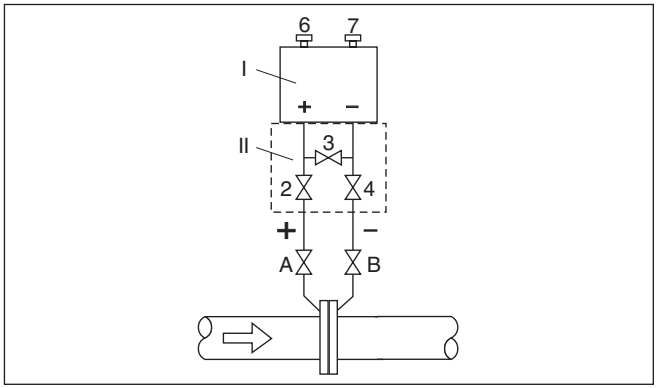


Fig. 48: Preferred measurment setup for gases

I DPT10
II 3-fold valve block
2.4 Inlet valves
3 Breather valve
6.7 Vent valves on DPT10
A, B Blocking valves

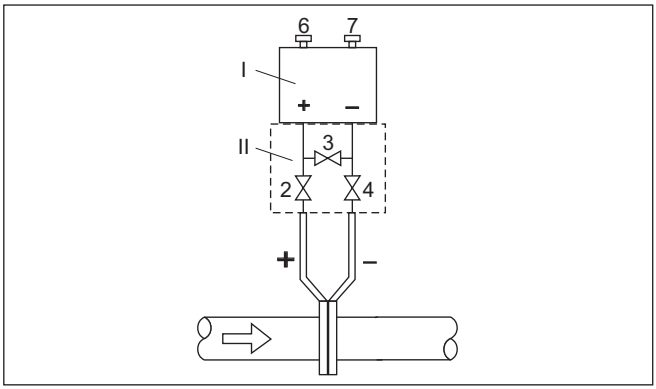


Fig. 49: Prefered measurement setup for gases, connection via 3-fold valve block, flanging on both sides

I DPT10
II 3-fold valve block
2.4 Inlet valves
3 Breather valve
6.7 Vent valves on DPT10

Measurement setup for liquids

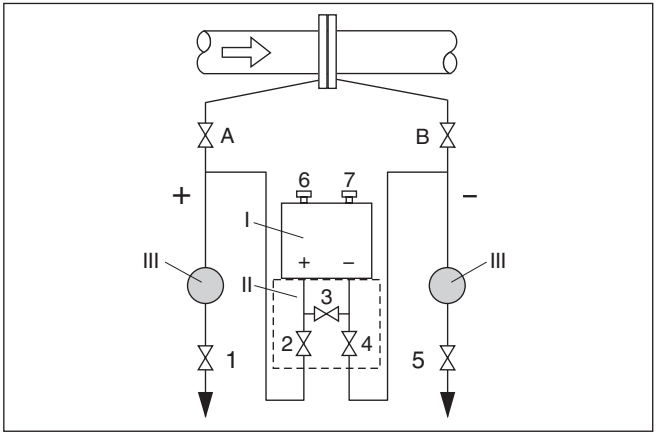


Fig. 50: Preferred measurement setup for liquids

I DPT10
II 3-fold valve block
III Precipitator
1.5 Drain valves
2.4 Inlet valves
3 Breather valve
6.7 Vent valves on DPT10
A, B Blocking valves

Prepare the adjustment

Proceed as follows:

1. Close valve 3

2. Fill measuring system with medium.

   For this purpose, open valves A, B (if available) as well as 2, 4: Medium flows in

   If necessary, clean the differential pressure lines: - with gases by blowing out with compressed air - with liquids by rinsing.[2)]

   For this purpose close valve 2 and 4, i.e. block the instrument.

   Then open valve 1 and 5 so that the effective pressure lines blow out/rinse.

   Close valves 1 and 5 (if available) after cleaning

3. Remove air from instrument:

   Open valves 2 and 4: Medium flows in

   Close valve 4: Minus side is closed

   Open valve 3: Equalisation plus and minus side

   Briefly open valve 6 and 7, then close again: Fill the measuring instrument completely with the medium and remove air

4. Carry out a position correction if the following conditions apply. If the conditions are not fulfilled, then carry out the position correction after step 6.

   Conditions:

   The process cannot be sealed off.

   The pressure extraction points (A and B) are at the same geodesic height.

5. Put measurement loop into operation:

   Close valve 3: Separate plus and minus side

   Open valve 4: Connect minus side

   Now:

   Valves 1, 3, 5, 6 and 7 are closed[3)]

   Valves 2 and 4 are open

   Valves A and B open

6. Carry out position correction, if flow can be blocked. In this case, step 5 is not required.

Then carry out adjustment, see chapter "*Set parameters*".

8.3 Level measurement

Instructions

For level measurements, all versions of DPT10 are employed.

DPT10 with double chemical seal is immediately ready for operation.

The DPT10 without chemical seal or with single chemical seal is ready for operation after opening a blocking valve, in case one is present.

Before you adjust DPT10 without chemical seal or with single chemical seal, the effective pressure lines must be cleaned and the instrument filled with the medium.

[2)] Arrangement with 5 valves.

[3)] Valves 1, 3, 5: Configuration with 5 valves.

Measurement setup for open vessels

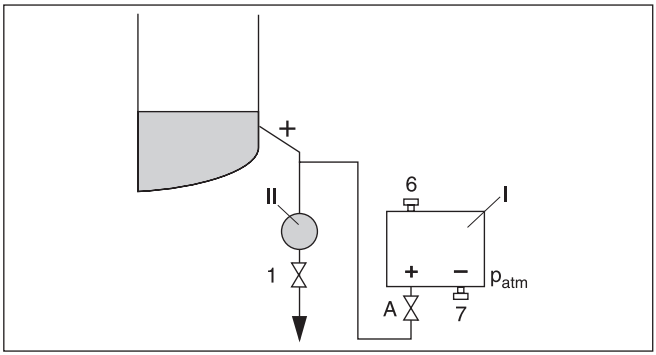


Fig. 51: Preferred measurement setup for open vessels

I DPT10
II Precipitator
1 Drain valve
6.7 Vent valves on DPT10
A Blocking valve

Prepare the adjustment

Proceed as follows:

1. Fill the vessel to just over the lower tap.
2. Fill measuring system with medium.

   Open valve A: Medium flows in.
3. Vent instrument

   Briefly open valve 6, then close it: Fill the measuring instrument completely with the medium and remove air.
4. Set measurement loop to operation

   Now:

   Valve A open and valve 6 closed

Then carry out adjustment, see below.

Measurement setup for closed vessels

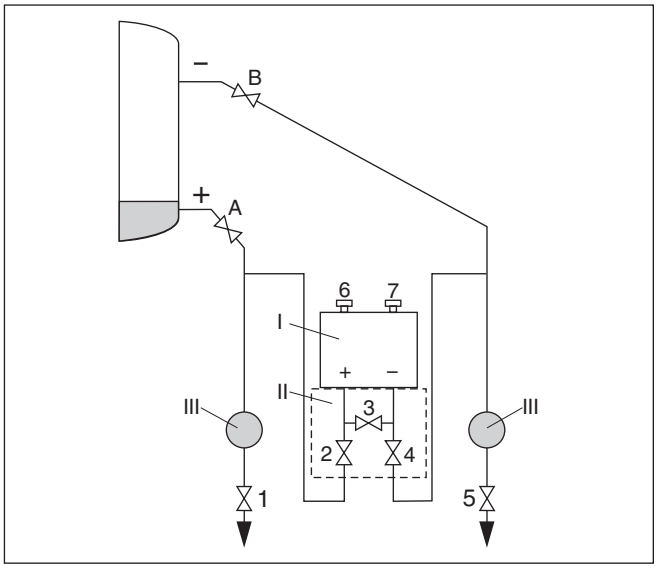


Fig. 52: Preferred measurement setup for closed vessels

I DPT10
II 3-fold valve block
III Precipitator
1, 5 Drain valves
2, 4 Inlet valves
6, 7 Vent valves on DPT10
A, B Blocking valves

Prepare the adjustment

Proceed as follows:

1. Fill the vessel to just above the lower tap
2. Fill measuring system with medium

   Close valve 3: Separate plus and minus side

   Open valve A and B: Open block valves
3. Vent plus side (probably empty minus side)

   Open valve 2 and 4: Discharge medium on the plus side

   Briefly open valve 6 and 7, then close again: Fill the plus side completely with the medium and remove air.
4. Set measurement loop to operation

   Now:

   Valve 3, 6 and 7 are closed

   Valves 2, 4, A and B are open

Then carry out adjustment, see below.

Measurement setup for closed vessels with steam overlay

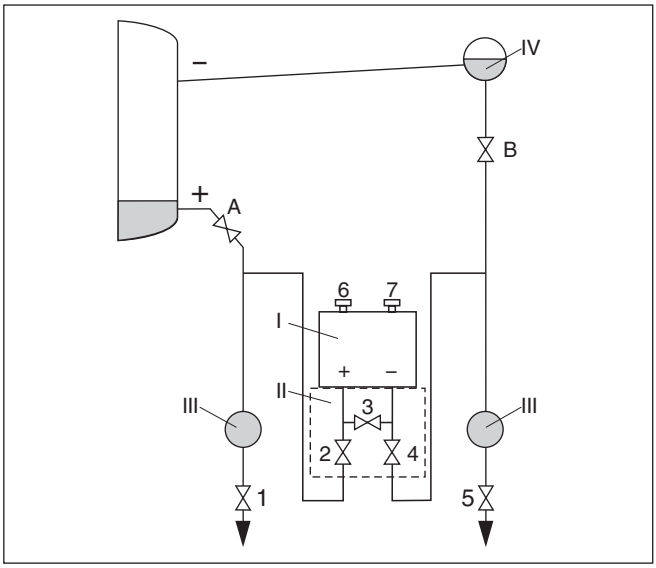


Fig. 53: Preferred measurement setup for closed vessels with steam overlay

I DPT10
II 3-fold valve block
III Precipitator
IV Condensate vessel
1, 5 Drain valves
2, 4 Inlet valves
3 Breather valve
6, 7 Vent valves on DPT10
A, B Blocking valves

Prepare the adjustment

Proceed as follows:

1. Fill the vessel to just above the lower tap
2. Fill measuring system with medium

   Open valve A and B: Open block valves

   Fill the minus effective pressure line on the height of the condensation pot
3. Remove air from instrument:

   Open valve 2 and 4: Discharge medium

   Open valve 3: Equalisation plus and minus side

   Briefly open valve 6 and 7, then close again: Fill the measuring instrument completely with the medium and remove air
4. Put measurement loop into operation:

   Close valve 3: Separate plus and minus side

   Open valve 4: Connect minus side

   Now:

   Valve 3, 6 and 7 are closed

Valves 2, 4, A and B are open.

Then carry out adjustment, see chapter "*Set parameters*".

8.4 Density and interface measurement

For density and interface measurements, DPT10 with double chemical seal is used.

DPT10 in this version is immediately ready for operation.

8.5 Differential pressure measurement

Instructions

For differential pressure measurements, DPT10 without chemical seal or with double chemical seal is used.

DPT10 with double chemical seal is immediately ready for operation.

Before adjusting DPT10 without chemical seal, the effective pressure lines must be cleaned and the instrument filled with medium.

Measurement setup for gases

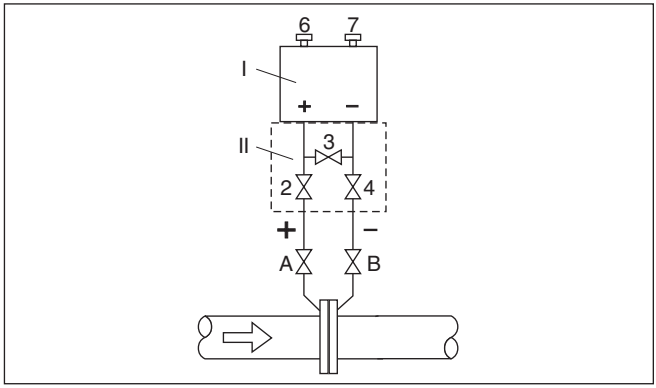


Fig. 54: Preferred measurment setup for gases

I DPT10
II 3-fold valve block
2, 4 Inlet valves
3 Breather valve
6, 7 Vent valves on DPT10
A, B Blocking valves

Measurement setup for liquids

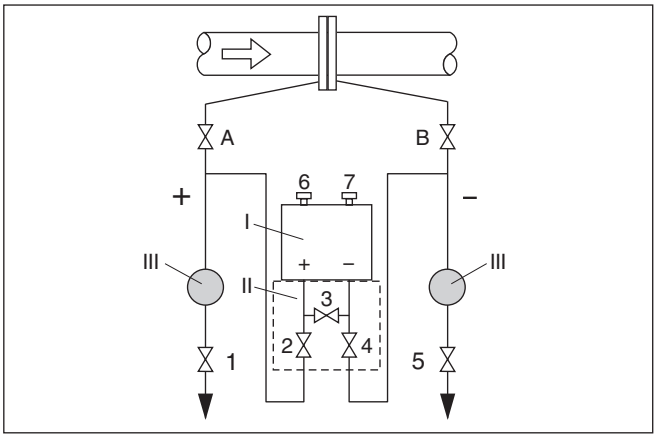


Fig. 55: Preferred measurement setup for liquids

I DPT10
II 3-fold valve block
III Precipitator
1.5 Drain valves
2.4 Inlet valves
3 Breather valve
6, 7 Vent valves on DPT10
A, B Blocking valves

Prepare the adjustment

Proceed as follows:

1. Close valve 3
2. Fill measuring system with medium.

   Open valves A, B, 2, 4: Medium flows in.

   If necessary, clean the differential pressure lines: - with gases by blowing out with compressed air - with liquids by rinsing.[4)]

   Close valve 2 and 4, block the instrument

   Open valve 1 and 5

   Close valve 1 and 5
3. Remove air from instrument:

   Open valves 2 and 4: Medium flows in

   Close valve 4: Minus side is closed

   Open valve 3: Equalisation plus and minus side

   Briefly open valve 6 and 7, then close again: Fill the measuring instrument completely with the medium and remove air
4. Put measurement loop into operation:

   Close valve 3: Separate plus and minus side

   Open valve 4: Connect minus side

   Now:

[4)] Arrangement with 5 valves.

Valves 1, 3, 5, 6 and 7 are closed[5)]

Valves 2 and 4 are open

Valves A and B open (if present)

Then carry out adjustment, see chapter "*Set parameters*".

[5)] Valves 1, 3, 5: Configuration with 5 valves.

9 Maintenance and fault rectification

9.1 Maintenance

Maintenance

If the instrument is used properly, no special maintenance is required in normal operation.

In some applications, product buildup on the separating diaphragms can influence the measuring result. Depending on the sensor and application, take precautions to ensure that heavy buildup, and especially a hardening thereof, is avoided.

9.2 Rectify faults

Reaction when malfunctions occur

The operator of the system is responsible for taking suitable measures to rectify faults.

Failure reasons

DPT10 offers maximum reliability. Nevertheless, faults can occur during operation. These may be caused by the following, e.g.:

- Sensor
- Process
- Voltage supply
- Signal processing

Fault rectification

The first measures to be taken are to check the output signals as well as to evaluate the error messages via the display and adjustment module. The procedure is described below. Further comprehensive diagnostics can be carried out on a PC with the software PACTware and the suitable DTM. In many cases, the causes can be determined and the faults rectified this way.

Checking Foundation Fieldbus

The following table describes possible errors and helps to remove them:

Error	Cause	Rectification
When an additional instrument is connected, the H1 segment fails.	Max. supply current of the segment coupler exceeded	Measure the current consumption, reduce size of segment
Measured value on the display and adjustment module does not correspond to the value in the PLC	The menu item "*Display - Display value*" is not set to "*AI-Out*"	Check values and correct, if necessary

Error	Cause	Rectification
Instrument does not appear during connection setup	Profibus DP cable pole-reversed	Check cable and correct, if necessary
	Incorrect termination	Check termination at the beginning and end points of the bus and terminate, if necessary, according to the specification
	Instrument not connected to the segment	Check and correct, if necessary

In Ex applications, the regulations for the wiring of intrinsically safe circuits must be observed.

Error messages via the display and adjustment module

Error code	Cause	Rectification
E013	no measured value available[1)]	– Exchange the instrument or send it in for repair
E017	Adjustment span too small	– repeat with modified values
E036	no operable sensor software	– Carry out a software update or send instrument for repair
E041	Hardware error	– Exchange the instrument or send it in for repair

Reaction after fault rectification

Depending on the reason for the fault and the measures taken, the steps described in chapter "*Set up*" may have to be carried out again.

9.3 Instrument repair

You can find information for a return shipment under "*Service*" on our local website.

If a repair is necessary, please proceed as follows:

- Complete one form for each instrument
- If necessary, state a contamination
- Clean the instrument and pack it damage-proof
- Attach the completed form and possibly also a safety data sheet to the instrument

10 Dismounting

10.1 Dismounting steps

Warning:
Before dismounting, be aware of dangerous process conditions such as e.g. pressure in the vessel or pipeline, high temperatures, corrosive or toxic products etc.

Take note of chapters "*Mounting*" and "*Connecting to power supply*" and carry out the listed steps in reverse order.

10.2 Disposal

The instrument consists of materials which can be recycled by specialised recycling companies. We use recyclable materials and have designed the parts to be easily separable.

WEEE directive 2002/96/EG
This instrument is not subject to the WEEE directive 2002/96/EG and the respective national laws. Pass the instrument directly on to a specialised recycling company and do not use the municipal collecting points. These may be used only for privately used products according to the WEEE directive.

Correct disposal avoids negative effects on humans and the environment and ensures recycling of useful raw materials.

Materials: see chapter "*Technical data*"

If you have no way to dispose of the old instrument properly, please contact us concerning return and disposal.

11 Supplement

11.1 Technical data

General data	
Pressure type	Differential pressure
Measuring principle	Piezoresistive
Communication interface	I^2C bus

Materials and weights	
Material 316L corresponds to stainless steel 1.4404 or 1.4435	
Materials, wetted parts	
– Process fitting with lateral flanges	C22.8, 316L, Alloy C276
– Separating diaphragm	316L, Alloy C-276, Tantalum, Alloy C-276 gold-rhodium coated
– Seal	FKM (Viton), FKM cleaned from oil and grease, FKM for oxygen application, PTFE, PTFE for oxygen application, NBR, copper, copper for oxygen application
– Screw plugs	316L
Internal transmission liquid	Synthetic oil, Halocarbon oil[1)]
Materials, non-wetted parts	
– Electronics housing	Plastic PBT (polyester), Alu die-casting powder-coated
– External electronics housing	plastic PBT (Polyester)
– Socket, wall mounting plate external electronics housing	plastic PBT (Polyester)
– Seal between housing socket and wall mounting plate	TPE (fixed connected)
– Seal ring, housing cover	Silicone
– Inspection window in housing cover for display and adjustment module	Polycarbonate (UL-746-C listed)
– Screws and nuts for lateral flange	PN 160: hexagon screw ISO 4014-M12 x 90-A4, PN 420: hexagon nut ISO 4032-M12-A4-bs
– Ground terminal	316Ti/316L
– Ohmic contact	Between ground terminal and process fitting
– Connection cable with version IP 68 (1 bar)	PE
– Connection between IP 68 transmitter and external electronics housing	PUR
– Type label support with IP 68 version on cable	PE hard
Max. torque screws mounting strap	30 Nm
Max. torque screws socket external housing	5 Nm (3.688 lbf ft)
Weight approx.	4.2 … 4.5 kg (9.26 … 9.92 lbs), depending on process fitting

Output variable	
Output	
– Signal	digital output signal, Foundation Fieldbus protocol
– Physical layer	according to IEC 61158-2
Channel Numbers	
– Channel 1	Primary value
– Channel 2	Secondary value 1
– Channel 3	Secondary value 2
– Channel 4	Temperature value
Transmission rate	31.25 Kbit/s
Current value	10 mA, ±0.5 mA

Dynamic behaviour output	
Run-up time	≤ 20 s

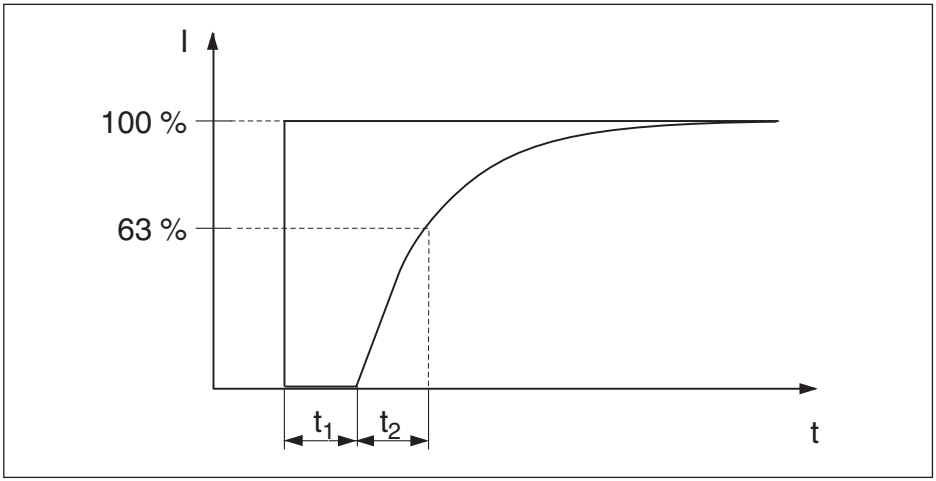


Fig. 56: Presentation of the dead time t_1 and the time constant t_2

Version, nominal measuring range	Dead time t_1	Time constant t_2
Basic version 10 bar and 30 bar	100 ms	250 ms
Basic version 100 mbar	100 ms	180 ms
Basic version 500 mbar	100 ms	180 ms
Basic version, 3 bar	100 ms	180 ms
Basic version 16 bar and 40 bar	100 ms	180 ms
Chemical seal version, all nominal measuring ranges	Dependent on the chemical seal	Dependent on the chemical seal

Bus response time with Foundation Fieldbus

– cyclically approx.	10 ms
– acyclically approx.	50 ms

Damping (63 % of the input variable)	0 … 999 s, adjustable

Additional output parameter - temperature

Processing is made via output signal HART multidrop, Profibus PA and Foundation Fieldbus

Range	-50 … +150 °C (-58 … +302 °F)
Resolution	1 °C (1.8 °F)
Accuracy in the range of 0 … +100 °C (+32 … +212 °F)	±3 K
Accuracy in the range of -50 … 0 °C (-58 … +32 °F) and +100 … +150 °C (+212 … +302 °F)	typ. ±3 K

Input variable

Measured variable Differential pressure, flow and level derived from it

Adjustment differential pressure

Adjustment range of the zero/span adjustment relating to the nominal measuring range:

– Pressure value zero	-120 … +120 %
– Pressure value span	zero + (-220 … +220 %)[2)]

Adjustment level

Adjustment range of the min./max. adjustment relating to the nominal measuring range:

– Percentage value	-10 … +110 %
– Pressure value	-120 … +120 %[3)]

Adjustment flow

Adjustment range of the zero/span adjustment relating to the nominal measuring range:

– Pressure value zero	-120 … +120 %
– Pressure value span	-120 … +120 %[4)]
Recommended max. turn down	15 : 1 (no limitation)

Nominal measuring ranges, measurement limits and smallest spans to be calibrated

Nominal range	Lower measurement limit	Upper measuring limit	Smallest adjustable span
10 mbar (1 kPa)	-10 mbar (-1 kPa)	+10 mbar (+1 kPa)	0.25 mbar (25 Pa)
30 mbar (3 kPa)	-30 mbar (-3 kPa)	+30 mbar (+3 kPa)	0.3 mbar (30 Pa)
100 mbar (10 kPa)	-100 mbar (-10 kPa)	+100 mbar (+10 kPa)	1 mbar (100 Pa)
500 mbar (50 kPa)	-500 mbar (-50 kPa)	+500 mbar (+50 kPa)	5 mbar (500 Pa)
3 bar (300 kPa)	-3 bar (-300 kPa)	+3 bar (+300 kPa)	30 mbar (3 kPa)
16 bar (1600 kPa)	-16 bar (-1600 kPa)	+16 bar (+1600 kPa)	160 mbar (16 kPa)
40 bar (4000 kPa)	-40 bar (-4000 kPa)	+40 bar (+4000 kPa)	400 mbar (40 kPa)

Reference conditions and actuating variables (according to DIN EN 60770-1)

Reference conditions according to DIN EN 61298-1

– Temperature	+18 … +30 °C (+64 … +86 °F)
– Relative humidity	45 … 75 %
– Air pressure	860 … 1060 mbar/86 … 106 kPa (12.5 … 15.4 psig)

Determination of characteristics	Limit point adjustment according to IEC 61298-2
Characterstic curve	Linear
Calibration position of the measuring cell	Vertical, i.e. upright process component
Influence of the installation position to the zero point	≤ 4 mbar[5)6)]

A position-dependent zero-point shift can be corrected (see also chapter "*Adjust parameter*").

Position of the span in the measuring range	Based on the zero point
Diaphragm material	316L, Alloy C276, gold rhodium plated, Monel
Filling oil	Silicone oil
Material, lateral flanges	316L

A position-dependent zero-point shift can be corrected (see also chapter "*Adjust parameter*").

Deviation determined according to the limit point method according to IEC 60770[7)]

Applies to **digital** interfaces (HART, Profibus PA, Foundation Fieldbus) as well as to **analogue** current output 4 … 20 mA. Specifications refer to the set span. Turn down (TD) is the ratio nominal measuring range/set span.

Deviation - All versions

The following applies to square root extracted characteristics: The accuracy data of DPT10 are entered with factor 0.5 in the accuracy calculation of the flow.

Deviation - Basic version

10 mbar, 30 mbar measuring cell	
– Turn down 1 : 1	±0.15 % of the set span
– Turn down > 1 : 1	±0.15 % of the set span x TD
100 mbar measuring cell	
– Turn down 1 : 1 to 4 : 1	±0.075 % of the set span
– Turn down > 4 : 1	±(0.012 x TD + 0.027) % of the set span
Measuring cells ≥ 500 mbar	
– Turn down 1 : 1 to 15 : 1	±0.075 % of the set span
– Turn down > 15 : 1	±(0.0015 x TD + 0.053) % of the set span

Deviation - Chemical seal versions

100 mbar measuring cell	
– Turn down 1 : 1 to 4 : 1	±0.075 % of the set span + influence of the chemical seal
– Turn down > 4 : 1	±(0.012 x TD + 0.027) % of the set span + influence of the chemical seal
Measuring cells ≥ 500 mbar	
– Turn down 1 : 1 to 15 : 1	±0.075 % of the set span + influence of the chemical seal
– Turn down > 15 : 1	±(0.0015 % x TD + 0.053 %) of the set span + influence of the chemical seal

Influence of the product or ambient temperature

Applies to instruments in basic version with **digital** signal output (HART, Profibus PA, Foundation Fieldbus) as well as to instruments with **analogue** current output 4 … 20 mA. Specifications refer to the set span. Turn down (TD) = nominal measuring range/set span.

Temperature range	Measuring range	Thermal changes of the zero signal and the output span relating to the adjusted span
-10 … +60 °C (+14 … +140 °F)	10 mbar, 30 mbar	±(0.31 x TD + 0.06) %
	100 mbar	±(0.18 x TD + 0.02) %
	500 mbar, 3 bar	±(0.08 x TD + 0.05) %
	16 bar	±(0.1 x TD + 0.1) %
	16 bar	±(0.08 x TD + 0.05) %
-40 … +10 °C (-40 … +50 °F) +60 … +85 °C (+140 … +185 °F)	10 mbar, 30 mbar	±(0.45 x TD + 0.1) %
	100 mbar	±(0.3 x TD + 0.15) %
	500 mbar, 3 bar	±(0.12 x TD + 0.1) %
	16 bar	±(0.15 x TD + 0.2) %
	40 bar	±(0.37 x TD + 0.1) %

Applies also to instruments with **analogue** 4 … 20 mA current output and refers to the set span.

Thermal change, current output < 0.05 %/10 K, max. < 0.15 %, each with -40 … +80 °C (-40 … +176 °F)

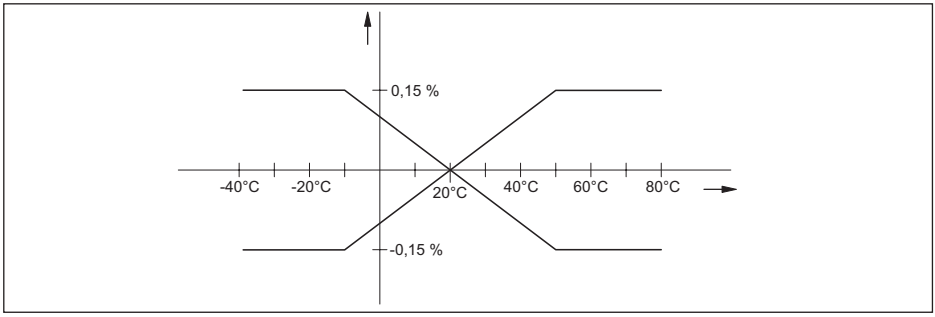


Fig. 57: Thermal change, current output

Influence of the system pressure on the zero point and span

316L, Alloy C276-, Alloy C276 gold-rhodium coated diaphragm

Measuring cell	10 mbar	30 mbar	100 mbar	500 mbar
Influence of the system pressure to the zero point	±0.15 % of URL/7 bar	±0.35 % of URL/70 bar	±0.15 % of URL/70 bar	±0.075 % of URL/70 bar
Influence of the system pressure to the span	±0.035 % of URL/7 bar	±0.14 % of URL/70 bar	±0.14 % of URL/70 bar	±0.14 % of URL/70 bar

Measuring cell	3 bar	16 bar	40 bar
Influence of the system pressure to the zero point	±0.075 % of URL/7 bar	±0.075 % of URL/70 bar	±0.075 % of URL/70 bar
Influence of the system pressure to the span	±0.14 % of URL/7 bar	±0.14 % of URL/70 bar	±0.14 % of URL/70 bar

Tantalum diaphragm

Measuring cell	10 mbar	30 mbar	100 mbar	500 mbar
Influence of the system pressure to the zero point	±0.28 % of URL/7 bar	±0.70 % of URL/70 bar	±0.42 % of URL/70 bar	±0.14 % of URL/70 bar
Influence of the system pressure to the span	±0.28 % of URL/7 bar	±0.70 % of URL/70 bar	±0.42 % of URL/70 bar	±0.14 % of URL/70 bar

Measuring cell	3 bar	16 bar	40 bar
Influence of the system pressure to the zero point	±0.14 % of URL/7 bar	±0.14 % of URL/70 bar	±0.14 % of URL/70 bar
Influence of the system pressure to the span	±0.14 % of URL/7 bar	±0.14 % of URL/70 bar	±0.14 % of URL/70 bar

Total accuracy

Total Performance - Basic version

The specification "*Total Performance*" comprises non-linearity incl. hysteresis and non-repeatability, thermal change of the zero point and static pressure influence (p_{st} = 70 bar).

Total Performance

- 316L, Alloy, gold-rhodium diaphragm ±0.15 % of the set span[8)9)]
- Tantalum diaphragm ±0.30 % of the set span[10)11)]

Total Error - basic version

The specification "*Total Error*" comprises the longterm stability and the total performance.

Diaphragm material	Measuring range	Total Error
316L, Alloy, gold rhodium	< 500 mbar	0.33 % of the measuring range end value/year
	from 500 mbar	0,20 % of the measuring range final value
Tantalum	< 500 mbar	0.48 % of the measuring range end value/year
	from 500 mbar	0.35 % of the measuring range end value/year

Heating time - all versions

Warm-up time ≤ 10 s

Ambient conditions

Ambient, storage and transport temperature

- Standard version -40 … +80 °C (-40 … +176 °F)
- Version for oxygen applications[12)] -40 … +60 °C (-40 … +140 °F)

- Versions IP 66/IP 68 (1 bar) connection cable PE -20 … +60 °C (-4 … +140 °F)
- Versions IP 66/IP 68 (1 bar) and IP 68, connection cable PUR -20 … +80 °C (-4 … +176 °F)

Process conditions

The pressure and temperature specifications are used as overview. In general, the max. pressure for the pressure transmitter depends on the weakest (with regard to pressure) link. In detail, the respective specifications of the type label apply.

Process temperature limits

Specifications apply to the basic version as well as to the minus side with version with single chemical seal[13)]

- With measuring cells PN 420 Lower temperature limit -10 °C (+14 °F).
- With effective pressure lines longer than 100 mm -40 … +120 °C (-40 … +248 °F)
- With effective pressure lines longer than 100 mm, process fitting steel C22.8 -40 … +120 °C (-40 … +248 °F)

Specifications apply to suitable chemical seals

- Chemical seal CSS plus side, CSB both sides -40 … +400 °C (-40 … +752 °F)

Process temperature limits according to the seal material

Seal material	Temperature limits
FKM	-20 … +85 °C (-4 … +185 °F)
FFKM (Kalrez 6375)	-5 … +85 °C (23 … +185 °F)
EPDM	-40 … +85 °C (-40 … +185 °F)
PTFE	-40 … +85 °C (-40 … +185 °F)
NBR	-20 … +85 °C (-4 … +185 °F)
Copper	-40 … +85 °C (-40 … +185 °F)
Copper, for oxygen application	-20 … +60 °C (-4 … +140 °F)
FKM, cleaned	-10 … +85 °C (+14 … +185 °F)
FKM, for oxygen application	-10 … +60 °C (-4 … +140 °F)
PTFE, for oxygen application	-20 … +60 °C (-4 … +140 °F)

Process pressure limits according to measuring range

Nominal range	Nominal pressure	Overload one-sided	Overload two-sided
10 mbar (1 kPa)	160 bar (16000 kPa)	160 bar (16000 kPa)	240 bar (24000 kPa)
30 mbar (3 kPa)	160 bar (16000 kPa)	160 bar (16000 kPa)	240 bar (24000 kPa)
100 mbar (10 kPa)	160 bar (16000 kPa)	160 bar (16000 kPa)	240 bar (24000 kPa)
500 mbar (50 kPa)	160 bar (16000 kPa) 420 bar (42000 kPa)	160 bar (16000 kPa) 420 bar (42000 kPa)	240 bar (24000 kPa) 630 bar (63000 kPa)
3 bar (300 kPa)	160 bar (16000 kPa) 420 bar (42000 kPa)	160 bar (16000 kPa) 420 bar (42000 kPa)	240 bar (24000 kPa) 630 bar (63000 kPa)

Nominal range	Nominal pressure	Overload one-sided	Overload two-sided
16 bar (1600 kPa)	160 bar (16000 kPa) 420 bar (42000 kPa)	160 bar (16000 kPa) 420 bar (42000 kPa)	240 bar (24000 kPa) 630 bar (63000 kPa)
40 bar (4000 kPa)	160 bar (16000 kPa) 420 bar (42000 kPa)	Plus side: 160 bar (16000 kPa) 420 bar (42000 kPa) Minus side: 100 bar (10000 kPa)	240 bar (24000 kPa) 630 bar (63000 kPa)

Process pressure limits with seal material FFKM (Kalrez 6375)

Nominal pressure	Overload one-sided	Overload two-sided
100 bar (10000 kPa)	100 bar (10000 kPa)	150 bar (15000 kPa)

Min. system pressure with all measuring ranges: 0.1 $mbar_{abs}$ (10 Pa_{abs})

Vibration resistance (mechanical vibrations with 5 … 100 Hz), depending on the version as well as the material and series of the electronics housing[14)]

- Single and double chamber plastic housing, single chamber Aluminium housing: 4 g
- Double chamber Aluminium housing, single chamber stainless steel housing: 1 g
- Double chamber stainless steel housing: <1 g

Shock resistance: Acceleration 100 g/6 ms[15)]

Electromechanical data - version IP 66/IP 67

Cable entry/plug[16)]

- Single chamber housing
  - 1 x cable gland M20 x 1.5 (cable: ø 5 … 9 mm), 1 x blind plug M20 x 1.5
  or:
  - 1 x closing cap ½ NPT, 1 x blind plug ½ NPT
  or:
  - 1 x plug (depending on the version), 1 x blind stopper M20 x 1.5
- Double chamber housing
  - 1 x cable entry M20 x 1.5 (cable: ø 5 … 9 mm), 1 x blind plug M20 x 1.5; plug M12 x 1 for the external display and adjustment unit (optional)
  or:
  - 1 x closing cap ½ NPT, 1 x blind plug ½ NPT, plug M12 x 1 for the external display and adjustment unit (optional)
  or:
  - 1 x plug (depending on the version), 1 x blind plug M20 x 1.5; plug M12 x 1 for the external display and adjustment unit (optional)

Spring-loaded terminals for wire cross-section up to	2.5 mm² (AWG 14)

Display and adjustment module	
Voltage supply and data transmission	through the sensor
Indication	LC display in dot matrix
Adjustment elements	4 keys
Protection rating	
– unassembled	IP 20
– mounted into the sensor without cover	IP 40
Material	
– Housing	ABS
– Inspection window	Polyester foil

Voltage supply	
Operating voltage	
– Non-Ex instrument	9 … 32 V DC
– Ex ia instrument	9 … 24 V DC
– Ex d instrument	9 … 32 V DC
Operating voltage with illuminated display and adjustment module	
– Non-Ex instrument	12 … 32 V DC
– Ex-ia instrument	12 … 24 V DC
Ex d instrument	12 … 32 V DC
Power supply by/max. number of sensors	
– Fieldbus	max. 32 (max. 10 with Ex)

Electrical protective measures	
Protection rating	
– Housing, standard	IP 66/IP 67
Overvoltage category	III
Protection class	II

Approvals

Depending on the version, instruments with approvals can have different technical data. For these instruments, please note the corresponding approval documents. They are included in the scope of delivery.

11.2 Information on Foundation Fieldbus

Block diagram, measured value processing

The following illustration shows the Transducer Block and Function block in simplified form.

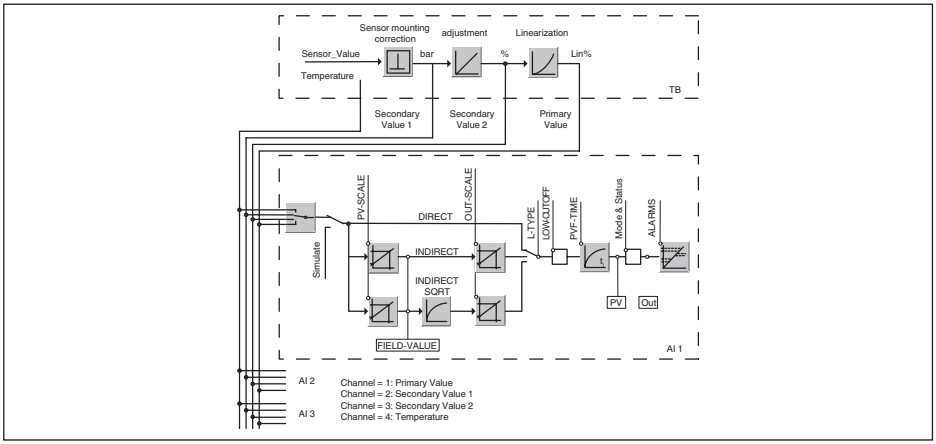


Fig. 58: Transducer Block DPT10

TB Transducer Block
AI Function Block (AI =Analogue Input)

Diagram, adjustment

The following illustration shows the function of the adjustment:

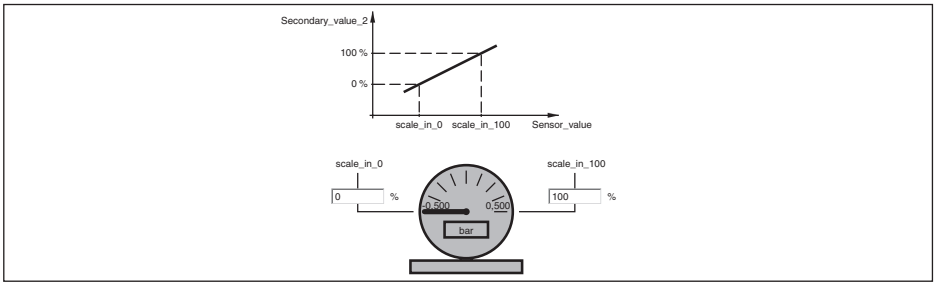


Fig. 59: Adjustment DPT10

Parameter list

The following list contains the most important parameters and their meaning:

- primary_value
  - Process Value after min/max-adjustment and linearization. Selected as input to AIFB by setting 'Channel' = 1. Unit derives from 'Primary_value_unit'
- primary_value_unit
  - Unit code of 'Primary_value'
  - %
- secondary_value_1
  - Process pressure. Selected as input to AIFB by setting 'Channel' = 2. Unit derives from 'Secondary_value_1_unit'
- secondary_value_1_unit
  - Unit code of 'Secondary_value_1'

  - bar, PSI, …, m, ft, …; in case of length type engineering unit and access to parameters the corresponding values will be converted by density factor
- secondary_value_2
  - Value after min/max-adjustment. Selected as input to AIFB by setting 'Channel' = 3. Unit derives from 'Secondary_value_2_unit'
- secondary_value_2_unit
  - Selected unit code for "secondary_value_2"
- sensor_value
  - Raw sensor value, i.e. the uncalibrated measurement value from the sensor. Unit derives from 'Sensor_range.unit'
- sensor_range
  - "Sensor_range.unit' refers to 'Sensor_value', 'Max/Min_peak_sensor_value', 'Cal_point_hi/lo'
  - includes sensor unit: bar, PSI …; only unit part of DS-68 is writable
- simulate_primary_value
- simulate_secondary_value_1
- simulate_secondary_value_2
- device status
  - "0: ""OK"" 13: ""non-specific error"" 17: ""Cal span too small"" 34: ""EEPROM memory fault"" 36: ""ROM memory fault"" 37: ""RAM memory fault"" 40: ""non-specific hardware fault"" 41: ""Sensor element not found"" 42: ""No leaking pulse"" 43: ""No trigger signal"" 44: ""EMI error"" 113: ""Communication hardware fault"""
- linearization type
  - Possible types of linearization are: linear, user defined, cylindrical lying container, spherical container
  - "0: ""Linear"" 1: ""User def"" 20: ""Cylindrical lying container"" 21: ""Spherical container"""
- curve_points_1_10
  - X and Y values for the user defined linearization curve
- curve_points_11_20
  - X and Y values for the user defined linearization curve
- curve_points_21_30
  - X and Y values for the user defined linearization curve
- curve_points_31_33
  - X and Y values for the user defined linearization curve
- curve status
  - Result of table plausibility check
  - "0: ""Uninitialized"" 1: ""Good"" 2: ""Not monotonous increasing"" 3: ""Not monotonous decreasing"" 4: ""Not enough values transmitted"" 5: ""Too many values transmitted"" 6: ""Gradient of edge too high"" 7: ""Values not excepted"" 8: ""Table currently loaded"" 9: ""Sorting and checking table"""
- SUB_DEVICE_NUMBER
- SENSOR_ELEMENT_TYPE
  - 0: "non-specific"
- display_source_selector
  - Selects the type of value that is displayed on the indication-/adjustement-module
  - "0: ""Physical value"" 1: ""Percent value"" 2: ""Lin percent value"" 6: ""Out(AI1)"" 7: ""Level"" 8: ""Out(AI2)"" 9: ""Out(AI3)"""
- max_peak_sensor_value
  - Holds the maximum sensor value. Write access resets to current value. Unit derives from 'Sensor_range.unit'
  - Write access resets to current value
- min_peak_sensor_value
  - Holds the minimum sensor value. Write access resets to current value. Unit derives from 'Sensor_range.unit'

  - Write access resets to current value
- CAL_POINT_HI
  - Highest calibrated value. For calibration of the high limit point you give the high measurement value (pressure) to the sensor and transfer this point as HIGH to the transmitter. Unit derives from 'Sensor_range.unit'
- CAL_POINT_LO
  - Lowest calibrated value. For calibration of the low limit point you give the low measurement value (pressure) to the sensor and transfer this point as LOW to the transmitter. Unit derives from 'Sensor_range.unit'
- CAL_MIN_SPAN
  - Minimum calibration span value allowed. Necessary to ensure that when calibration is done, the two calibrated points (high and low) are not too close together. Unit derives from 'Sensor_range.unit'
- SCALE_IN
  - Min/max-adjustment: Upper and lower calibrated points of the sensor. Unit derives from 'Sensor_range.unit'
- trimmed_value
  - Sensor value after the trim processing. Unit derives from 'Sensor_range.unit'
- sensor_sn
  - Sensor serial number
- temperature
  - Process temperature. Selected as input to AIFB by setting 'Channel' = 4. Unit derives from 'Temperature.unit'
- temperature_unit
  - Unit code of 'Temperature', 'Max/Min_peak_temperature_value'
  - °C, °F, K, °R
- max_peak_temperature_value
  - Holds the maximum process temperature. Write access resets to current value. Unit derives from 'Temperature.unit'
  - Write access resets to current value
- min_peak_temperature_value
  - Holds the minimum process temperature. Write access resets to current value. Unit derives from 'Temperature.unit'
  - Write access resets to current value

11.3 Dimensions

Plastic housing

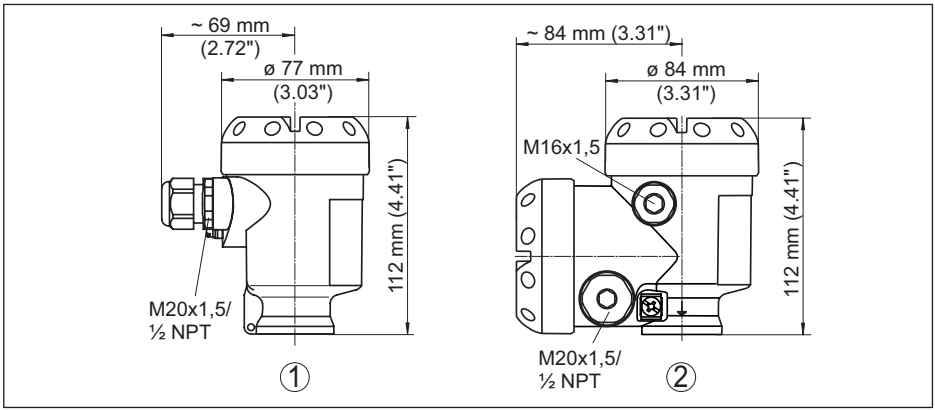


Fig. 60: Housing versions in protection IP 66/IP 68 (0.2 bar) - with integrated display and adjustment module the housing is 9 mm/0.35 in higher

1 Single chamber version
2 Double chamber version

Aluminium housing

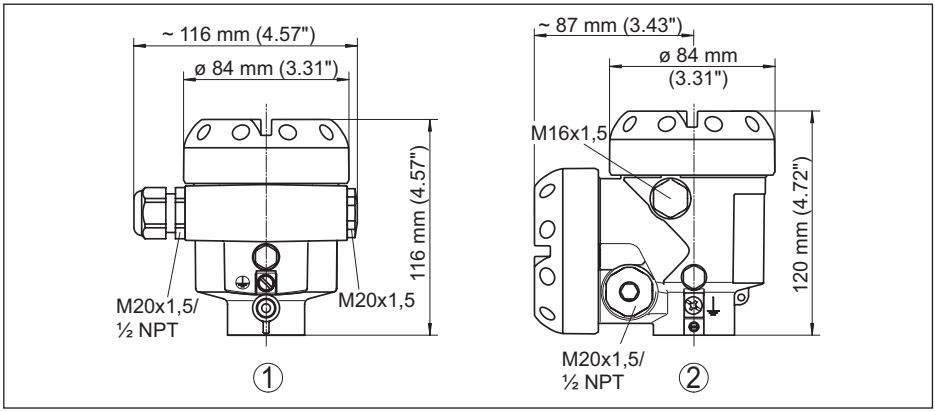


Fig. 61: Housing versions in protection IP 66/IP 68 (0.2 bar) - with integrated display and adjustment module the housing is 9 mm/0.35 in higher

1 Single chamber version
2 Double chamber version

Aluminium housing in protection rating IP 66/IP 68 (1 bar)

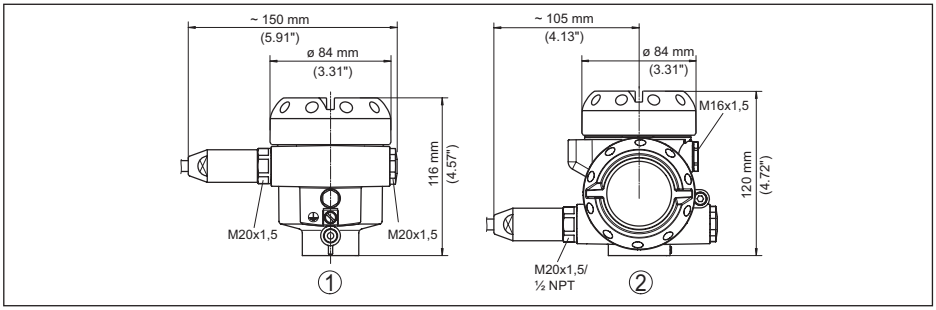


Fig. 62: Housing versions in protection IP66/IP68 (1 bar) - with integrated display and adjustment module the housing is 9 mm/0.35 in higher

1 Single chamber version
2 Double chamber version

Stainless steel housing

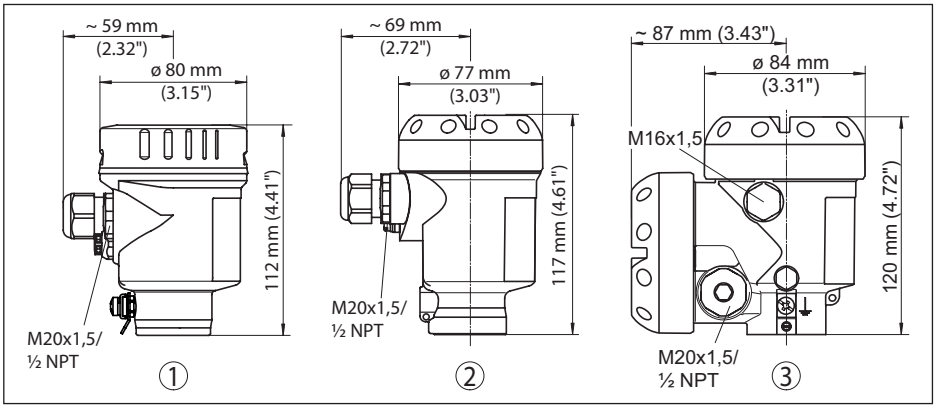


Fig. 63: Housing versions in protection IP 66/IP 68 (0.2 bar) - with integrated display and adjustment module the housing is 9 mm/0.35 in higher

1 Single chamber version, electropolished
2 Single chamber version, precision casting
3 Double chamber version, precision casting

Oval flange, connection ¼-18 NPT or RC ¼

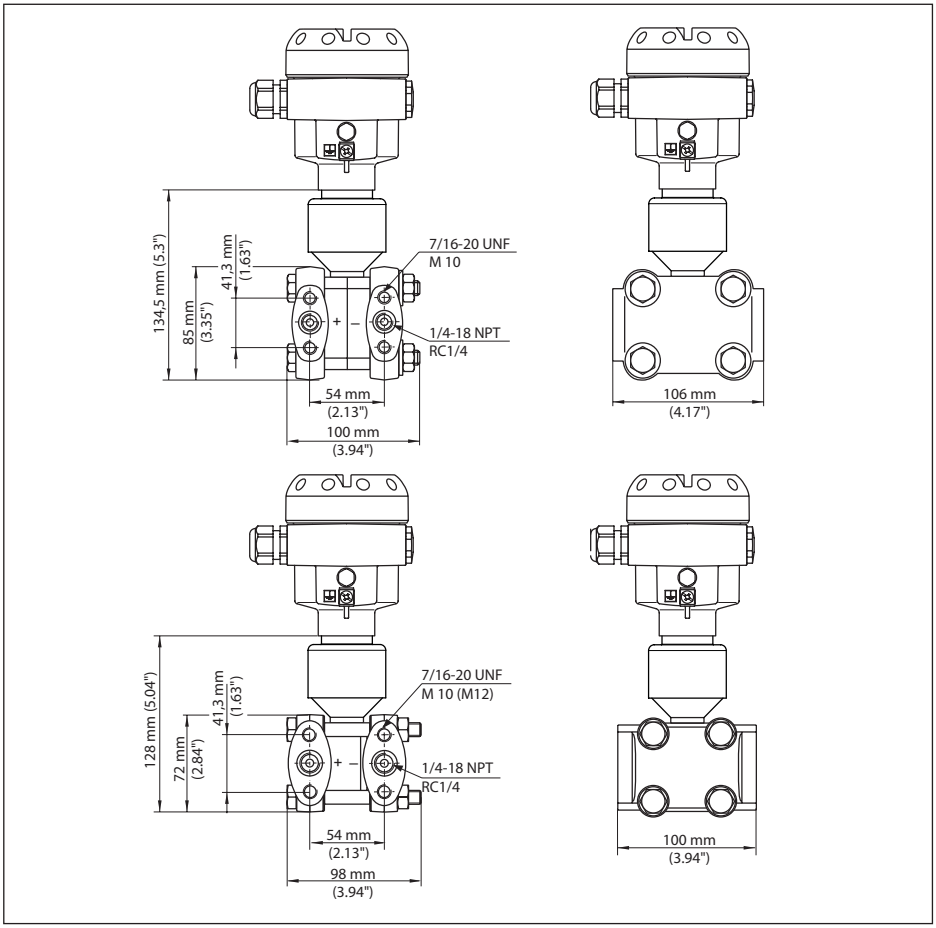


Fig. 64: Top: 10 mbar and 30 mbar measuring cell. Bottom: Measuring cell ≥ 100 mbar

Version	Connection	Fastening	Material	Scope of delivery
B	1/4-18 NPT IEC 61518	7/16-20 UNF	Steel C 22.8	incl. 2 vent valves (316L)
D	1/4-18 NPT IEC 61518	7/16-20 UNF	AISI 316L	incl. 2 vent valves (316L)
F	1/4-18 NPT IEC 61518	7/16-20 UNF	Alloy C276	without valves/closing screws
U	RC 1/4	7/16-20 UNF	AISI 316L	incl. 2 vent valves (316L)
1	1/4-18 NPT IEC 61518	PN 160: M10, PN 420: M12	Steel C 22.8	incl. 2 vent valves (316L)

Version	Connection	Fastening	Material	Scope of delivery
2	1/4-18 NPT IEC 61518	PN 160: M10, PN 420: M12	AISI 316L	incl. 2 vent valves (316L)
3	1/4-18 NPT IEC 61518	PN 160: M10, PN 420: M12	Alloy C276	without valves/closing screws

Oval flange, connection ¼-18 NPT or RC ¼, with lateral ventilation

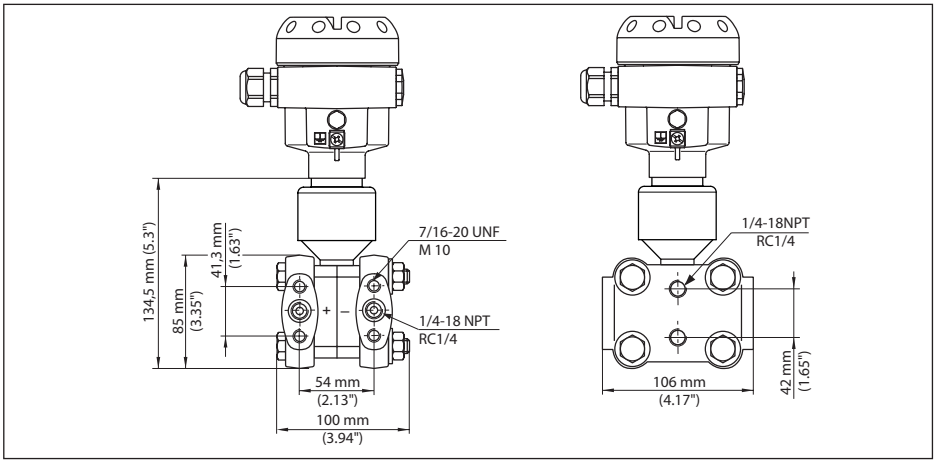


Fig. 65: 10 mbar and 30 mbar measuring cell

Version	Connection	Fastening	Material	Scope of delivery
C	1/4-18 NPT IEC 61518	7/16-20 UNF	Steel C 22.8	incl. 4 closing screws (AISI 316L) and 2 ventilation valves
E	1/4-18 NPT IEC 61518	7/16-20 UNF	AISI 316L	incl. 4 closing screws (AISI 316L) and 2 ventilation valves
H	1/4-18 NPT IEC 61518	7/16-20 UNF	Alloy C276	without valves/closing screws
V	RC 1/4	7/16-20 UNF	AISI 316L	incl. 4 closing screws (AISI 316L) and 2 ventilation valves

Oval flange, prepared for chemical seal connection

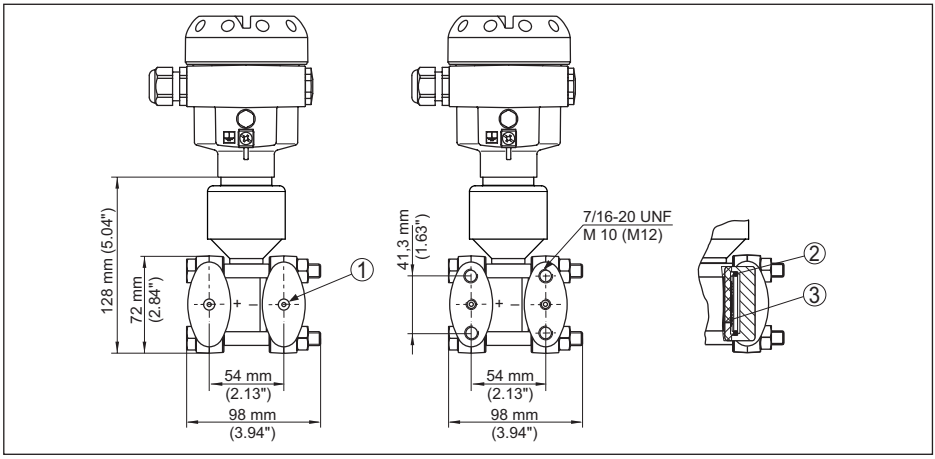


Fig. 66: left: Process fitting DPT10 prepared for chemical seal assembly. right: Position of the copper ring seal

1 Chemical seal connection
2 Copper ring seal
3 Cup diaphragm

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Printing date:

All statements concerning scope of delivery, application, practical use and operating conditions of the sensors and processing systems correspond to the information available at the time of printing.

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